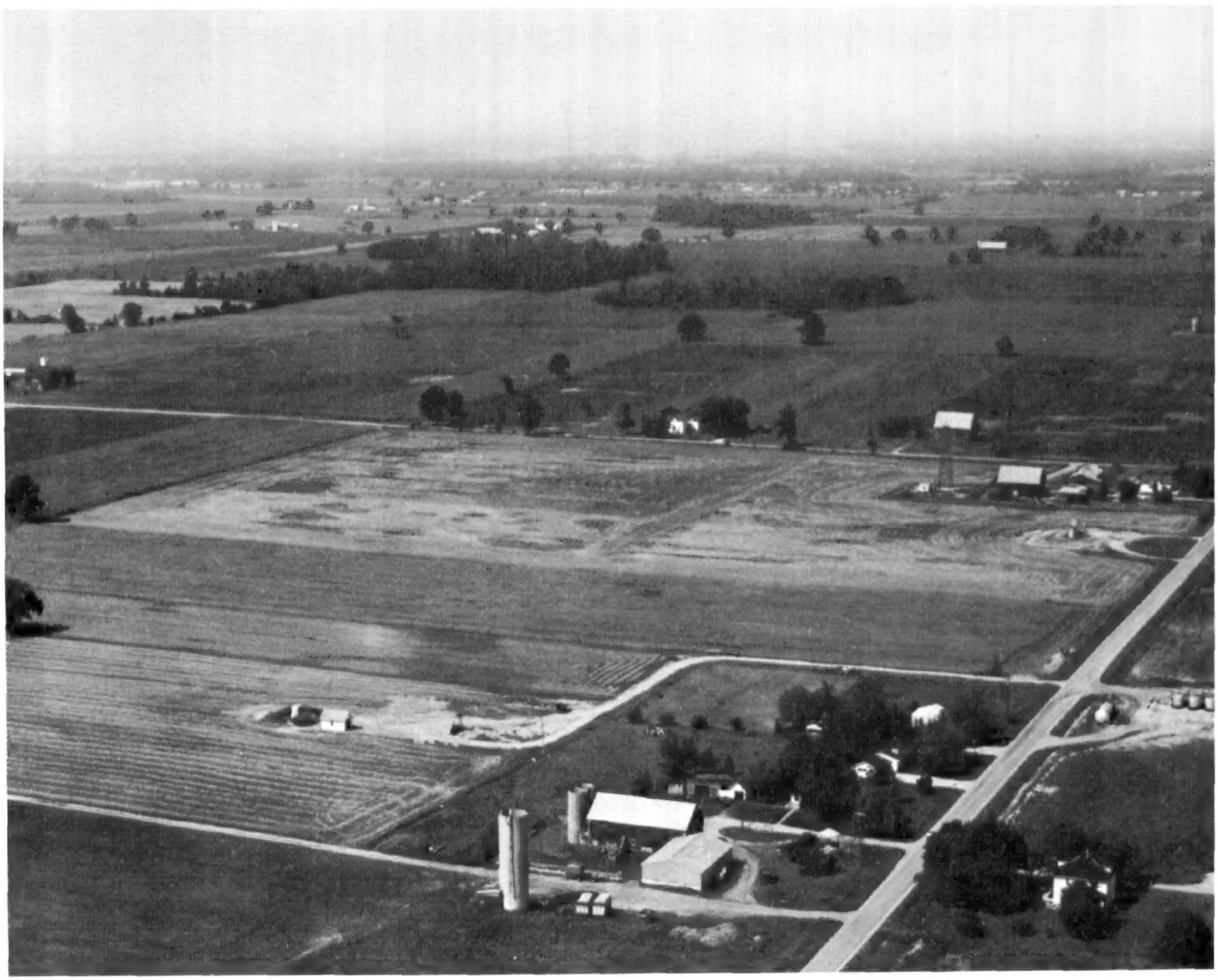
United States Department of Agriculture

Soil Conservation Service

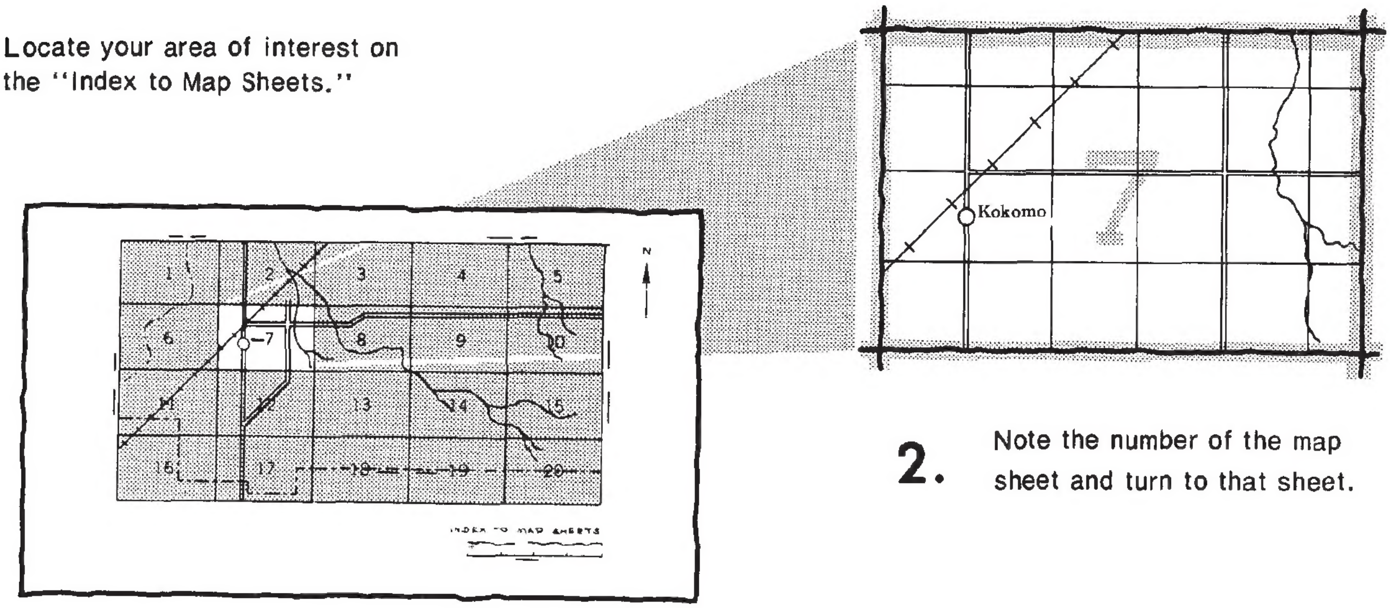
In cooperation with Michigan Department of Agriculture, Michigan Agricultural Experiment Station, and Michigan Technological University

Soil Survey of Isabella County Michigan



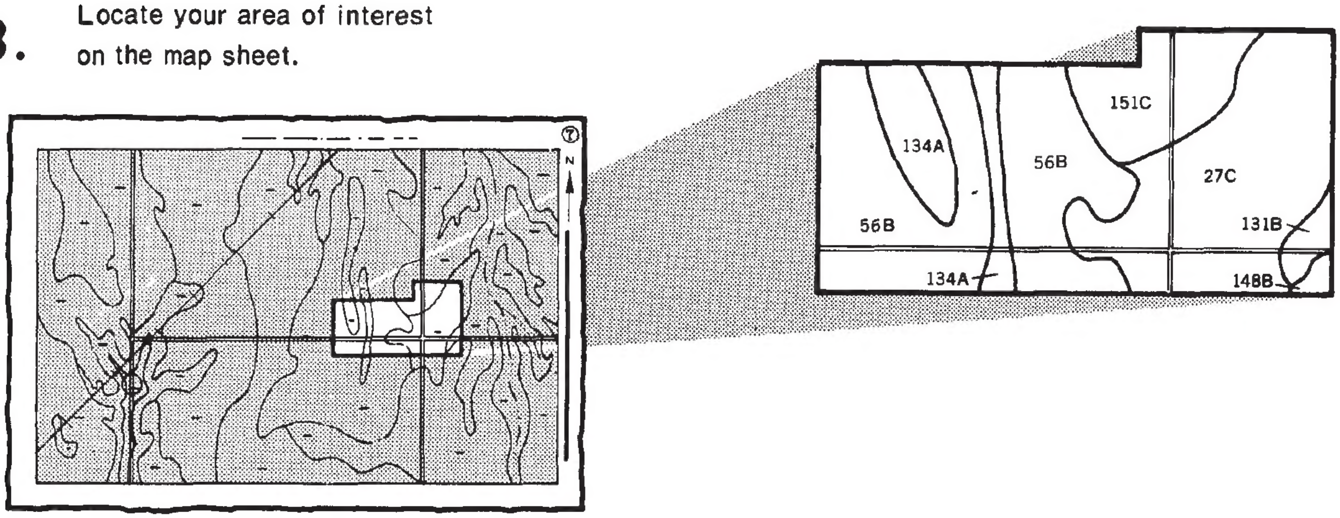
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets."

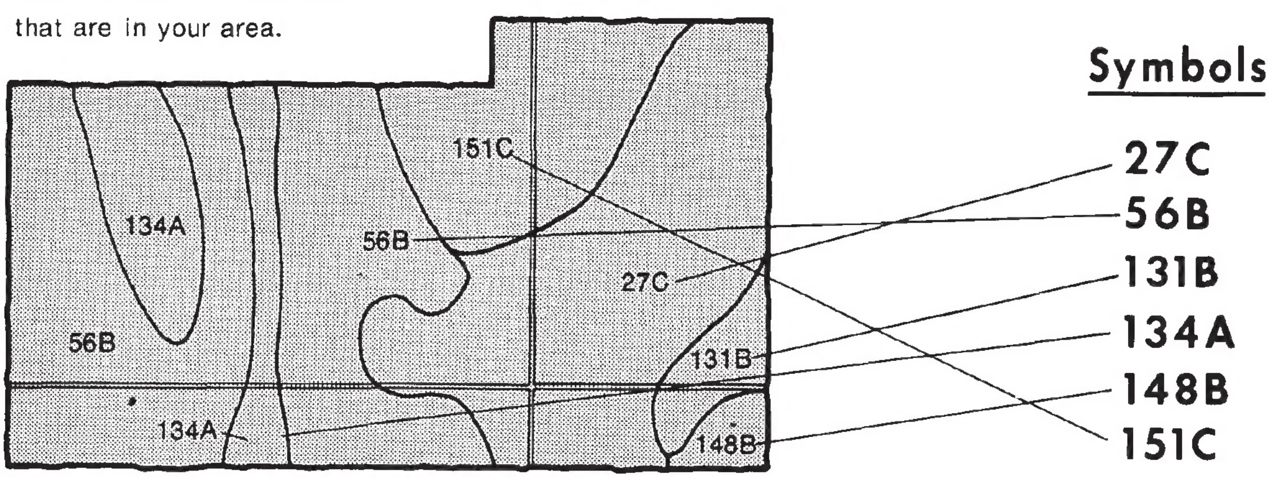


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

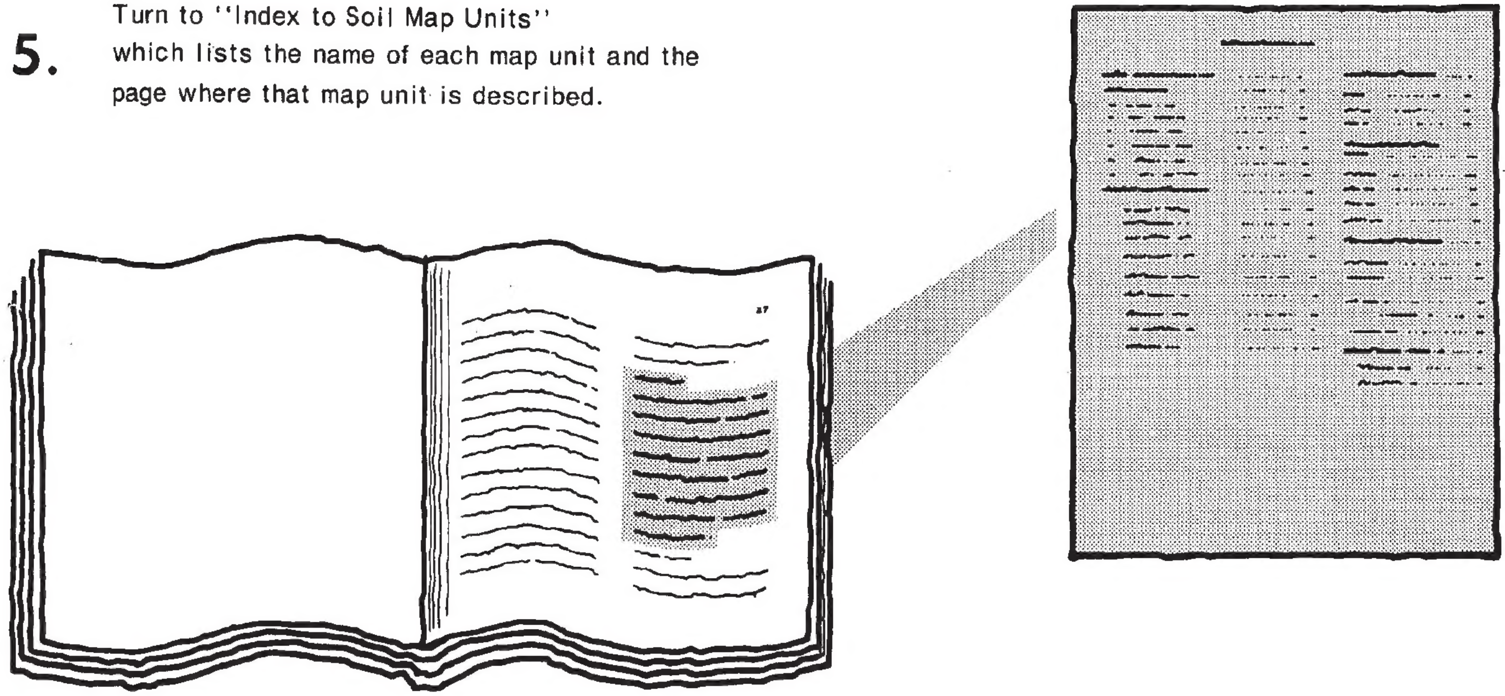


4. List the map unit symbols that are in your area.

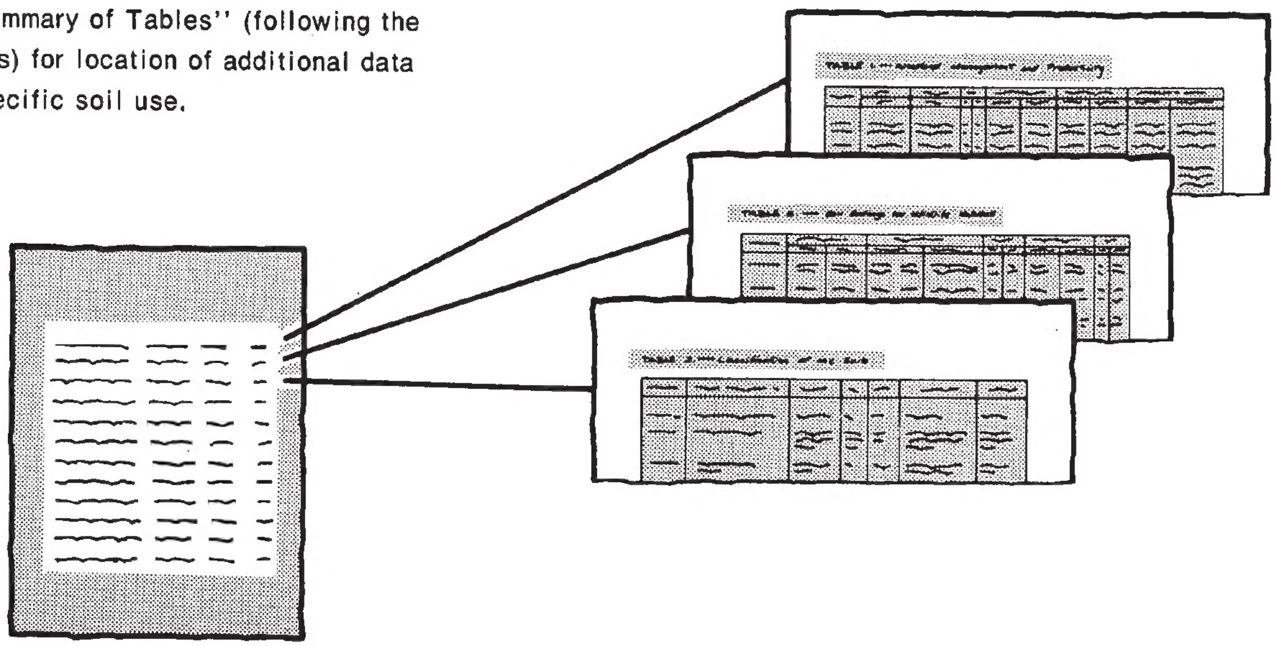


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1982. This survey was made cooperatively by the Soil Conservation Service and the Michigan Department of Agriculture, Michigan Agricultural Experiment Station, and Michigan Technological University. It is part of the technical assistance furnished to the Isabella Soil Conservation District. Financial assistance was made available by the Isabella County Board of Commissioners.

Cover: An area of the Ithaca-Ziegenfuss association used for agricultural production.

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Soil Series

Issued August 1985

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Isabella County, Michigan. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Homer R Hilner

Homer R. Hilner
State Conservationist
Soil Conservation Service

Location of Isabella County in Michigan.

Soil Survey of Isabella County, Michigan

By Robert L. McLeese and Stephen W. Tardy, Soil Conservation Service

Fieldwork by Erik P. Johnson, Michigan Department of Agriculture, and
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Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
In cooperation with Michigan Department of Agriculture,
Michigan Agricultural Experiment Station, and Michigan Technological University

ISABELLA COUNTY is near the center of lower Michigan. It is bordered by Mecosta County on the west, Clare County on the north, Midland County on the east, and Montcalm and Gratiot Counties on the south. It has an area of 573 square miles, or 366,720 acres. Mt. Pleasant, the county seat, is in the central part of the county. In 1980, the population of Isabella County was about 54,110.

Most of Isabella County is on undulating to moderately sloping moraines, nearly level water-worked till plains, and outwash plains. Deeply entrenched drainageways dissect the county. Streams flow easterly to Saginaw Bay. The Chippewa River is the largest river in the county.

Farming is the main economic enterprise in the county. The major crops are corn, soybeans, dry beans, and hay.

The major industries in Isabella County are concerned with producing oil and servicing oil wells. Small industries include sawmills and industrial and auto-parts manufacturing.

Soil scientists have determined that there are about 36 kinds of soils in Isabella County. The soils range widely in texture, natural drainage, slope, and other characteristics (fig. 1). Wetness is a major limitation to the use of many of these soils. Extensive tile drainage, however, has made the soils well suited to field crops. Because of wetness, many of the soils generally are poorly suited to most other uses.

The sloping soils in Isabella County are dominantly well drained and vary widely in texture. Erosion generally is a severe hazard on these soils, and measures are needed to control erosion and reduce sedimentation in streams. If well managed, the soils are suited to field crops and pasture. The well drained soils, which make up about half of the county, are well suited to urban development.

General Nature of the County

This section provides general information concerning Isabella County. It discusses climate, history and development, physiography, lakes and streams, farming, and industry and transportation.

Climate

Prepared by the Michigan Department of Agriculture, Climatology Division, East Lansing, Michigan.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Mount Pleasant in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 23 degrees F, and the average daily minimum temperature is 15.4 degrees. The lowest temperature on record, which occurred at Mount Pleasant on February 5, 1918, is -30 degrees. In summer the average temperature is 68.8 degrees, and the average daily maximum temperature is 81.2 degrees. The highest recorded temperature, which occurred at Mount Pleasant on July 13,1936, is 106 degrees.

Figure 1.—Light colored Ithaca soils are adjacent to the darker Belleville soils.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 30.25 inches. Of this, 18.98 inches, or 63 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 15.3 inches. The heaviest 1-day rainfall during the period of record was 4.25 inches at Mount Pleasant on July 8, 1957. In Lansing, thunderstorms occur on about 34 days each year, and most occur in June. The wettest month was September 1945, in which 10.54 inches of precipitation was received. The driest month was March 1910, in which no precipitation was received.

The average seasonal snowfall is 36.1 inches. The greatest snow depth at any one time during the period of record was 25 inches on January 14, 1979. The greatest seasonal snowfall was 66.0 inches received in 1971-72. The lowest seasonal snowfall was 7.8 inches received in 1936-37. The heaviest 1-day snowfall on record was 17.0 inches on January 23, 1898. The month in which snowfall was greatest was January 1967, in which 28.1 inches fell.

The average relative humidity in midafternoon is about 64 percent. Humidity is higher at night, and the average at dawn is about 84 percent. The sun shines 67 percent of the time possible in summer and 37 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12.0 miles per hour, in January in Lansing.

History and Development

Isabella County was part of Oakland and Saginaw Counties until 1831, when it was made a separate entity *(7)*. Mt. Pleasant, the county seat, was incorporated as a city in 1889.

Among the early inhabitants of the area were the Chippewa Indians. Beginning in the 1850's, timber interests began to move into the area. In 1855, the Isabella Chippewa Indian Reservation was established just outside Mt. Pleasant.

In the 1850's and 1860's, many logging camps and towns were built and then abandoned as the timber resources were harvested. Between 1870 and 1890, a large number of pioneers moved into the area, clearing the land and establishing farms. Since the late 1920's, Mt. Pleasant and Isabella County have been a center for the Michigan oil industry.

The County Normal School, established in 1895, went on to become Central Michigan College. It was granted university status in 1959.

Grain, dairy and beef farming, and schools and industries based in Mt. Pleasant have become the mainstays of Isabella County's economy.

Physiography

Isabella County is in the physiographic center of Michigan's lower peninsula. This is a broad glaciated upland area known as the Southern Michigan and Northern Indiana Drift Plain.

Most of the topographic features of the county formed during the latest glaciation, the Wisconsin. The part of the glacier that covered Michigan began to recede about 14,000 years ago and moved completely out about 8,000 years ago. The glacial drift that was left as the ice melted covers the entire county to a depth of several hundred feet. It formed such topographic features as moraines, till plains, outwash plains, and glacial drainageways.

The principal divisions of surface features occur in belts extending generally north and south. The eastern part of the county lies on broad, nearly level till plains that have been worked by glacial water. The rivers and streams that flow through this area have cut deep, steep-sided drainageways through the till plain. Natural drainage is poor.

The central belt of the county is mainly on undulating to rolling moraines, outwash plains, and till plains. Elevation increases in a westerly direction. The smaller drainageways of intermittent streams do not have well-defined channels. Natural drainage is generally good.

In the western belt, the surface features vary. Much of the land is fairly smooth, but deep, steep-sided valleys and prominent isolated hills are numerous. Except for the hills and the short, steep slopes to the streams, most of the area is moderately or gently rolling.

Lakes and Streams

About 45 named lakes and ponds are scattered throughout Isabella County. These water areas differ in size, shape, and shoreline characteristics. They range in size from less than 5 acres to more than 500 acres. Some are in marshes and exhibit all stages of filling by vegetation. The larger lakes are concentrated in the northern half of the county. Among them are Lake Isabella, which is about 550 acres in size; Stevenson Lake, about 140 acres; Coldwater Lake, about 280 acres; and Littlefield Lake, about 200 acres.

Isabella County has four major drainage systems: the North and South Branches of the Chippewa River, the Pine River, the North Branch of the Salt River, and the Little Salt River.

The North and South Branches of the Chippewa River drain the central and northwestern parts of the county. The Chippewa River flows to the east and leaves the county in Chippewa Township. The Coldwater River is a major tributary.

The Pine River drains the southwestern part of the county. It enters the county at Blanchard and flows to the southeast, leaving the county in Fremont Township. Skunk Creek and Pony Creek are major tributaries.

The North Branch of the Salt River drains the northeastern part of the county. Its headwaters are located in central Wise Township. It flows to the east and leaves the county in Denver Township, where the South Branch of the Salt River joins it as its major tributary.

The Little Salt River drains the southeastern part of the county. It has its headwaters in central Lincoln Township. It also flows to the east and leaves the county in Coe Township. It is fed by several major agricultural drainage ditches.

Farming

Early settlers came into the county in the 1850's to clear the land and take away a large share of the timber. Between 1870 and 1900, a heavy influx of settlers cleared the land and established farmsteads. During this time, general farming was practiced mainly on the more clayey soils in the central part of the county.

In 1880, Isabella County had 1,679 farms totaling approximately 141,000 acres. By 1900, there were 3,436 farms making up about 257,000 acres. Between 1900 and 1920, the number of farms declined by about 100, and the acreage in farmland increased to approximately 320,000 acres. By 1949, the number of farms had declined to 2,249, and farm acreage had decreased to about 288,000 acres. According to the latest available census of agriculture, the acreage in farms has declined further, to about 205,000 acres.

Figure 2.—No-till corn on Spinks sand. No-till improves water intake and reduces erosion.

In 1951, the Isabella County Soil and Water Conservation District was formed to assist landowners in preventing soil erosion and pollution.

Corn is the main crop grown in Isabella County (fig. 2). Small grains, hay, beans, and dairy products are also important.

Industry and Transportation

Several export firms are based in Isabella County. Exports include commercial refrigeration units, industrial clutches and couplings, oil well equipment, commercial auto washing equipment, and forestry and wood harvesting equipment.

The coarse sand and gravel in many areas of the county are important sources of roadfill. Several hundred oil and gas wells are scattered throughout the county.

Three airports serve the county. One, in Mt. Pleasant, serves small commuter lines and private planes. The other two, one at Lake Isabella and one at Ojibwa Development Company, serve small private planes.

Two railroad freight lines serve the county.

Two U.S. highways and one state highway link Isabella County with all points in the state.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; and the kinds of crops and native

plants growing on the soils. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Some of the boundaries on the soil maps of Isabella County do not match those on the soil maps of adjacent counties, and some of the soil names and descriptions do not agree. The differences are a result of improvements in the classification of soils, particularly modifications or refinements in soil series concepts. Also, there may be differences in the intensity of mapping or in the extent of the soils within the survey area.

This soil survey supersedes the soil survey of Isabella County published in 1925 *(9)*. This survey provides additional information and contains larger maps that show the soils in greater detail.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit or association on the general soil map is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in other associations but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

Nearly level to rolling, well drained to poorly drained soils

These soils are used mainly as cropland. They are well suited or moderately well suited to this use. Soil blowing and water erosion are hazards. Wetness, maintaining good soil tilth, increasing or maintaining the content of organic matter, and droughtiness are management concerns.

The soils have medium potential for use as septic tank absorption fields and building sites. Permeability, depth to the water table, slope, shrink-swell potential, and poor filtering capacity are limitations to these uses.

1. Remus-Spinks Association

Nearly level to gently rolling, well drained loamy and sandy soils; on moraines and outwash plains

The Remus and Spinks soils are in broad upland areas. The slope is 0 to 12 percent.

This association makes up about 12 percent of the survey area. It is about 45 percent Remus and similar soils, 35 percent Spinks and similar soils, and 20 percent soils of minor extent.

The Remus soils are well drained. They have a surface layer of dark brown fine sandy loam about 9 inches thick. The next part is mixed dark yellowish brown loam and brown sandy loam about 29 inches thick. The subsoil is about 14 inches thick. It is dark yellowish brown loam in the upper part and dark brown sandy loam in the lower part. The substratum is brown, calcareous loam.

The Spinks soils are well drained. They have a surface layer of dark brown sand about 9 inches thick. The subsurface layer, about 11 inches thick, is yellowish brown sand. Between depths of 20 and 60 inches there are alternating bands of light yellowish brown sand and strong brown loamy sand.

Of minor extent are the very poorly drained Gilford and Adrian soils in drainageways and other depressional areas.

The soils in this association are used mainly as cropland. Corn is the most commonly grown crop. In a few areas, these soils are used as pasture or woodland.

The soils are moderately well suited to use as cropland. Soil blowing and water erosion are hazards. Conserving soil moisture during dry periods and increasing or maintaining the content of organic matter are management concerns. In some areas, pebbles and cobbles on the surface layer make seedbed preparation and harvesting difficult.

The soils in this association are well suited to use as pasture and woodland. Conserving soil moisture is a management concern on the Spinks soils if they are used as pasture. If either of these soils are used as woodland, plant competition is a management concern. Seedling mortality is a management concern on the Spinks soils.

The soils in this association have high potential for use as septic tank absorption fields and building sites. The poor filtering capacity of the Spinks soils and the moderate permeability of the Remus soils, however, are limitations to use as septic tank absorption fields. The gently rolling and rolling slopes are additional limitations to these uses.

2. Perrinton-Ithaca Association

Nearly level to gently rolling, well drained and somewhat poorly drained loamy soils; on moraines and till plains

The Perrinton soils are in broad upland areas, and the Ithaca soils are on foot slopes and in lower positions on the landscape (fig. 3). The slope is 0 to 12 percent.

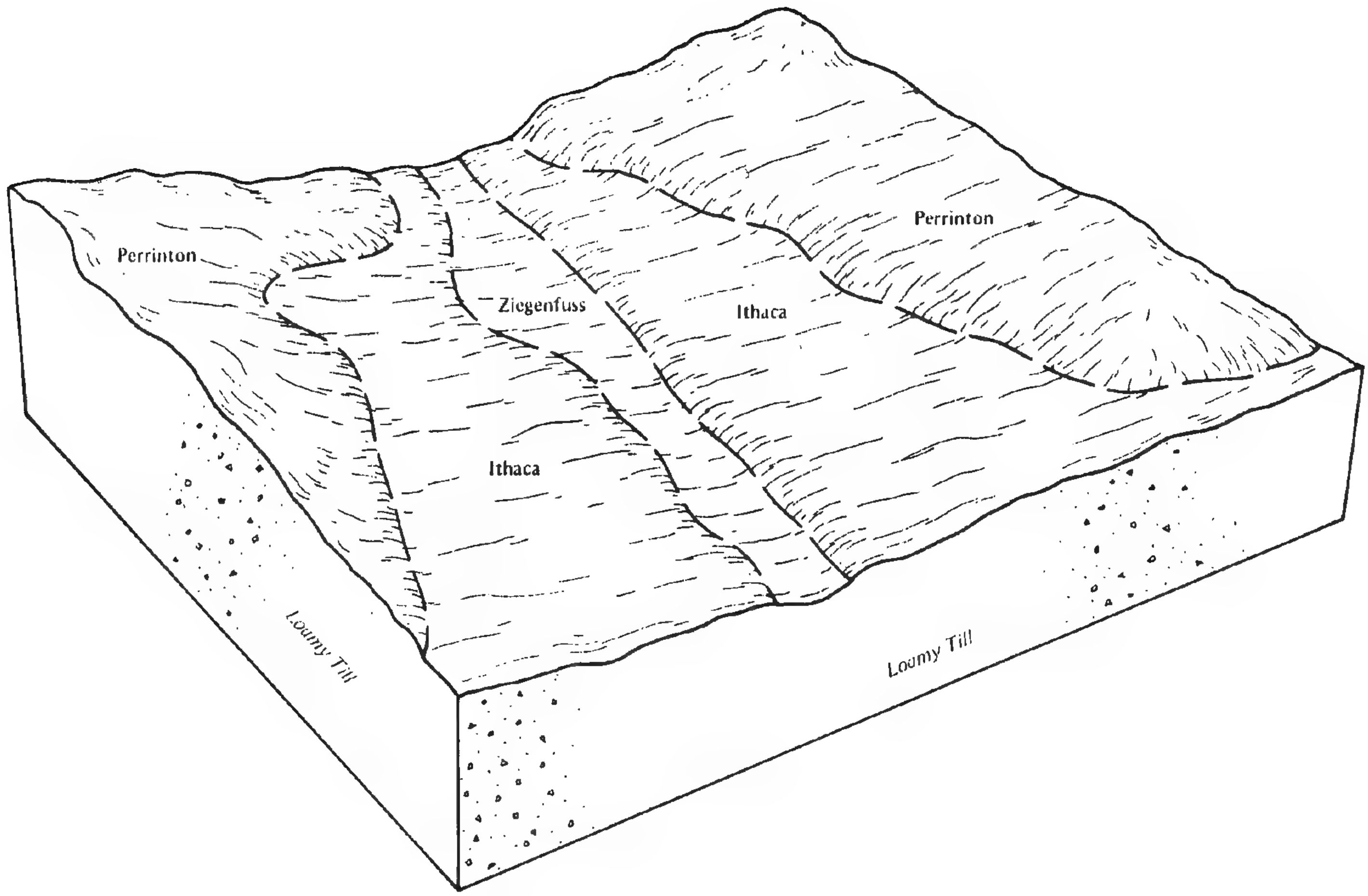

Figure 3.—Typical pattern of soils and underlying material in the Perrinton-Ithaca association.

This association makes up about 33 percent of the survey area. It is about 38 percent Perrinton and similar soils, 31 percent Ithaca and similar soils, and 31 percent soils of minor extent.

The Perrinton soils are well drained. They have a surface layer of dark brown loam about 11 inches thick. The next layer, about 5 inches thick, is mixed dark brown clay loam and pale brown loam. The subsoil, about 20 inches thick, is dark yellowish brown clay loam. The substratum is yellowish brown, calcareous clay loam.

The Ithaca soils are somewhat poorly drained. They have a surface layer of dark brown loam about 10 inches thick. The next layer is mixed, dark brown clay loam and brown, mottled loam about 4 inches thick. The subsoil is dark brown, mottled clay loam about 16 inches thick. The substratum is brown, mottled, calcareous clay loam.

Of minor extent are the somewhat poorly drained, sandy Selfridge soils on low knolls and ridges and the poorly drained Ziegenfuss and Parkhill soils and the very poorly drained Pinnebog, Adrian, and Edwards soils in depressions and along drainageways.

The soils in this association are used mainly as cropland. Corn is the most commonly grown crop. In a few areas, the soils are used as pasture or woodland.

The soils are well suited to use as cropland and pasture. Water erosion is a hazard on the Perrinton soils, and maintaining good soil tilth is a management concern on all the soils. Wetness is an additional concern on the Ithaca soils. If pastures are overgrazed, water erosion is a hazard and soil compaction is a management concern.

The soils are well suited to use as woodland. Plant competition is a management concern. On the Ithaca soils, windthrow, seedling mortality, and equipment limitations are additional management concerns.

The soils have high potential for use as building sites; slope and wetness are limitations. Potential is medium for use as septic tank absorption fields; slope, wetness, and moderately slow permeability are limitations.

3. Guelph-Londo-Parkhill Association

Nearly level to gently rolling, well drained, somewhat poorly drained, and poorly drained loamy soils; on moraines and till plains

The Guelph soils are on broad upland areas, the Londo soils are on foot slopes and in lower positions on the landscape, and the Parkhill soils are in depressions and along drainageways (fig. 4). The slope is 0 to 12 percent.

This association makes up about 6 percent of the survey area. It is about 35 percent Guelph and similar soils, 30 percent Londo and similar soils, 10 percent Parkhill and similar soils, and 25 percent soils of minor extent.

The Guelph soils are well drained. They have a surface layer of very dark grayish brown loam about 9 inches thick. The next layer, about 4 inches thick, is mixed dark yellowish brown clay loam and pale brown sandy loam. The subsoil, about 12 inches thick, is dark yellowish brown clay loam. The substratum is yellowish brown, mottled, calcareous loam.

The Londo soils are somewhat poorly drained. They have a surface layer of very dark grayish brown loam about 9 inches thick. The next layer is mixed, yellowish brown loam and light yellowish brown, mottled sandy loam about 5 inches thick. The subsoil, about 8 inches thick, is dark yellowish brown clay loam. The substratum is grayish brown and brown, mottled, calcareous loam.

The Parkhill soils are poorly drained. They have a surface layer of very dark grayish brown loam about 9 inches thick. The subsoil, about 26 inches thick, is grayish brown, mottled loam. The substratum is grayish brown, mottled, calcareous loam.

Of minor extent are the somewhat poorly drained, sandy Selfridge soils on foot slopes and on low knolls and ridges and the very poorly drained Pinnebog soils in bogs and other depressional areas.

The soils in this association are used mainly as cropland. Corn is the most commonly grown crop. In a few areas, the soils are used as pasture or woodland.

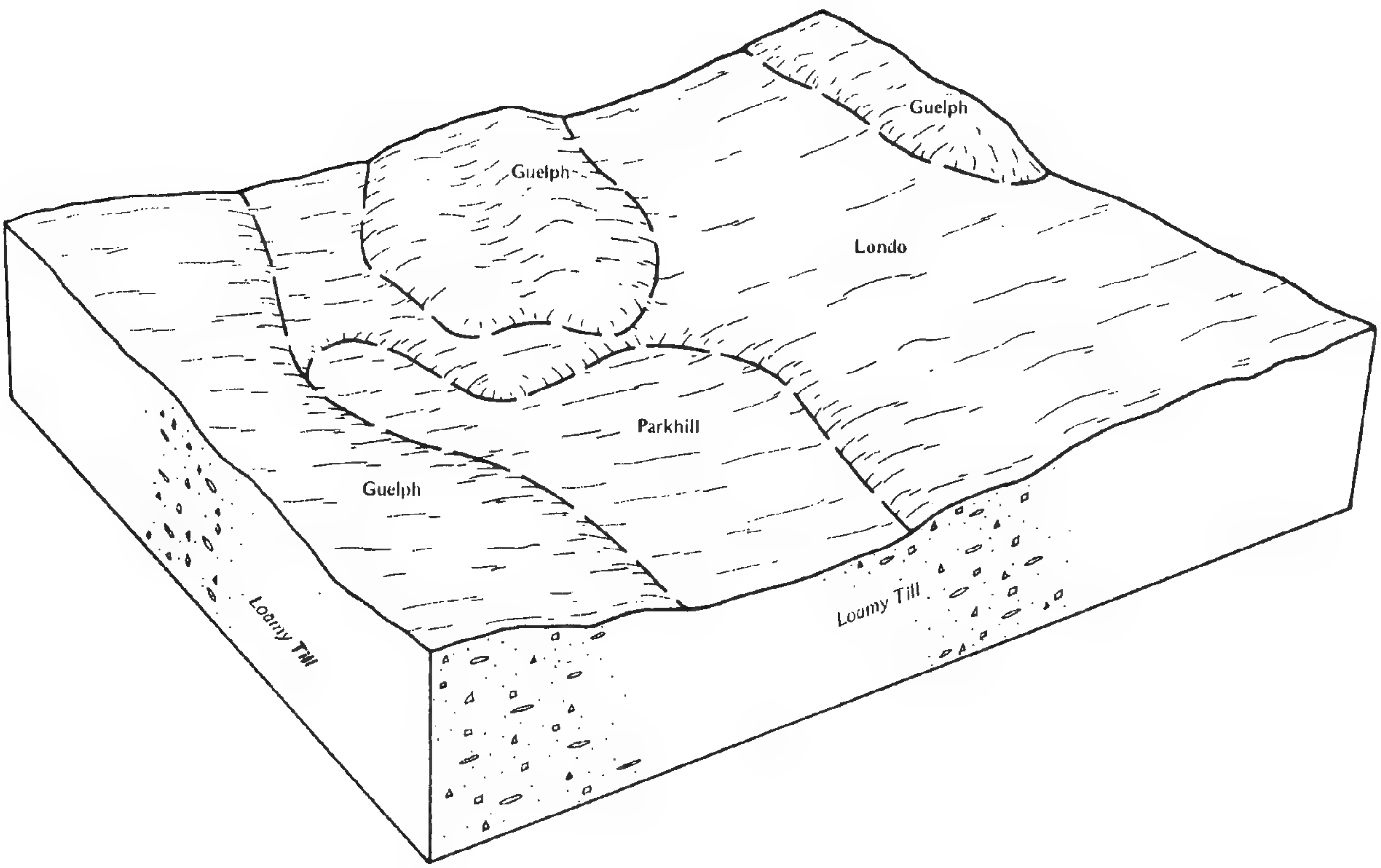

Figure 4.—Typical pattern of soils and underlying material in the Guelph-Londo-Parkhill association.

The soils are well suited or moderately well suited to use as cropland or pasture. If these soils are used as cropland, maintaining good tilth is a management concern. Water erosion is a hazard on the Guelph soils. Wetness is an additional management concern on the Londo and Parkhill soils.

If pastures are overgrazed, soil compaction is a management concern. On the Londo and Parkhill soils, wetness is an additional management concern.

These soils are well suited to use as woodland. Plant competition is a management concern. On the Parkhill and Londo soils, windthrow, equipment limitations, and seedling mortality are additional concerns.

The Guelph soils have high potential for use as septic tank absorption fields and building sites. The Londo soils have medium potential for these uses because of wetness and moderate or moderately slow permeability. The Parkhill soils have low potential for these uses because of wetness and moderately slow permeability.

4. Marlette-Spinks Association

Nearly level to rolling, well drained loamy and sandy soils; on moraines and till plains

The Marlette and Spinks soils are in broad upland areas. The slope is 0 to 20 percent.

This association makes up about 6 percent of the survey area. It is about 35 percent Marlette and similar soils, 20 percent Spinks and similar soils, and 45 percent soils of minor extent.

The Marlette soils are well drained. They have a surface layer of dark brown loam about 9 inches thick. The next part is firm and mixed, dark brown clay loam and pale brown sandy loam about 9 inches thick. The subsoil, about 22 inches thick, is dark brown, friable clay loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous clay loam.

The Spinks soils are well drained. They have a surface layer of dark brown sand about 9 inches thick. The subsurface layer, about 11 inches thick, is yellowish brown sand. Between depths of 20 and 60 inches there are alternating bands of strong yellowish brown loose sand and strong brown loamy sand.

Of minor extent are the somewhat poorly drained Londo and Selfridge soils on low knolls and ridges and the poorly drained Corunna soils in depressions and drainageways.

The soils in this association are used mainly as cropland. Corn is the most commonly grown crop. In a few areas, the soils are used as pasture or woodland.

The Marlette soils are well suited to poorly suited to use as cropland and pasture, depending on the slope. The Spinks soils are moderately well suited to crops and well suited to pasture in areas where the slope is less than 12 percent. Water erosion is a hazard on these soils and maintaining good soil tilth is a management concern on the Marlette soils. On Spinks soils, soil blowing is a hazard, and droughtiness and the low content of organic matter are management concerns. If the soils are used as pasture, droughtiness and soil compaction are management concerns.

These soils are well suited to use as woodland. Plant competition is a management concern. Seedling mortality is an additional concern on the Spinks soils.

The soils in this association have a high potential for use as septic tank absorption fields and building sites. The poor filtering capacity of the Spinks soils and the moderately slow permeability of the Marlette soils, however, are limitations for septic tank absorption fields.

Nearly level, somewhat poorly drained and poorly drained sandy soils

These soils are used mainly as woodland, and they are fairly well suited to this use. Equipment limitations and windthrow are management concerns.

The soils have medium or low potential for use as septic tank absorption fields and building sites. Wetness and the poor filtering capacity of the soils are limitations.

5. Pipestone-Kingsville Association

Nearly level, somewhat poorly drained and poorly drained sandy soils; on glacial deltas, till plains, outwash plains, and beach ridges

The Pipestone soils are in broad, flat areas. The Kingsville soils are in lower positions on the landscape and along drainageways (fig. 5). The slope is 0 to 3 percent.

This association makes up about 7 percent of the survey area. It is about 56 percent Pipestone and similar soils, 27 percent Kingsville and similar soils, and 17 percent soils of minor extent.

The Pipestone soils are somewhat poorly drained. They have a surface layer of black sand about 2 inches thick. The subsurface layer is light brownish gray, mottled sand about 2 inches thick. The subsoil is mottled sand about 27 inches thick. In the upper part it is dark brown and very friable, and in the lower part it is dark yellowish brown and loose. The substratum is yellowish brown, mottled sand.

The Kingsville soils are poorly drained. They have a surface layer of black loamy sand about 8 inches thick. The subsoil is multicolored, loose sand about 22 inches thick. The substratum to a depth of 60 inches is dark grayish brown sand.

Of minor extent are the somewhat poorly drained, less droughty Selfridge soils on low knolls and ridges and the moderately well drained Covert soils on knolls and ridges.

In most areas, the soils in this association have a natural cover of trees and shrubs. The soils are used mainly as recreation areas and as habitat for wildlife. In places, they are used as cropland and pasture. Corn is the most commonly grown crop.

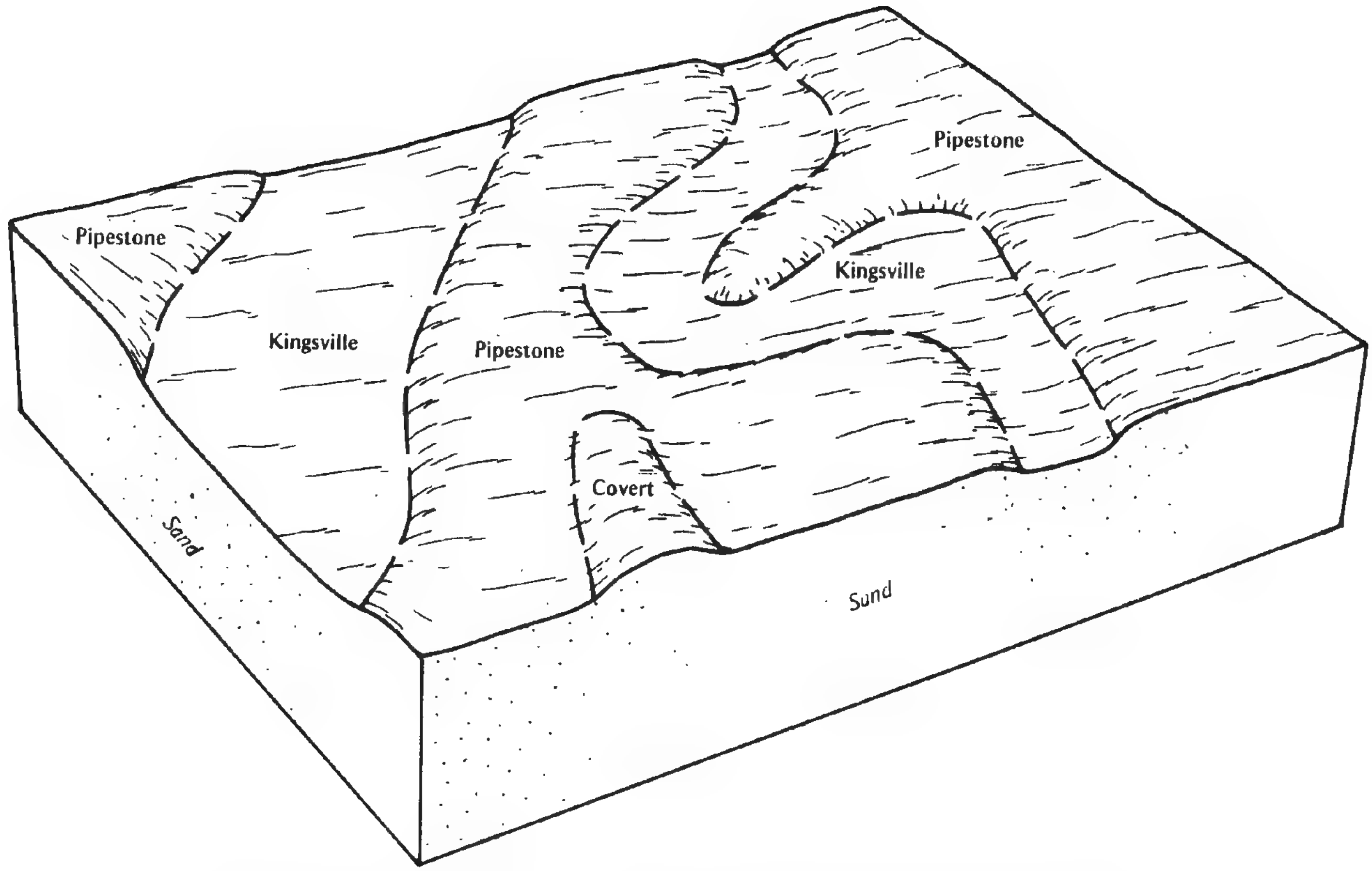

Figure 5.—Typical pattern of soils and underlying material in the Pipestone-Kingsville association.

These soils are well suited to use as woodland. Windthrow, equipment limitations, plant competition, and seedling mortality are management concerns.

These soils are poorly suited to use as cropland and are moderately well suited to use as pasture. Soil blowing is a hazard. Wetness, low content of organic matter, and the need to conserve soil moisture during dry periods are management concerns.

The Pipestone soils have medium potential and the Kingsville soils have low potential for use as septic tank absorption fields and building sites. Wetness and the poor filtering capacity of the soils are limitations.

6. Londo-Parkhill-Wixom Association

Nearly level and undulating, somewhat poorly drained and poorly drained loamy and sandy soils; on till plains, outwash plains, and beach ridges

The Londo soils are in broad, flat areas. The Wixom soils are on low knolls and low ridges, and the Parkhill soils are in depressions and along drainageways. The slope is 0 to 4 percent.

This association makes up about 7 percent of the survey area. It is about 34 percent Londo and similar soils, 23 percent Parkhill and similar soils, 16 percent Wixom and similar soils, and 27 percent soils of minor extent.

The Londo soils are somewhat poorly drained. They have a surface layer of very dark grayish brown loam about 9 inches thick. The next layer is mixed, yellowish brown loam and light yellowish brown, mottled sandy loam about 5 inches thick. The subsoil, about 8 inches thick, is dark yellowish brown clay loam. The substratum is grayish brown and brown, mottled, calcareous loam.

The Parkhill soils are poorly drained. They have a surface layer of very dark grayish brown loam about 9 inches thick. The subsoil, about 26 inches thick, is grayish brown, mottled loam. The substratum is grayish brown, mottled, calcareous loam.

The Wixom soils are somewhat poorly drained. They have a surface layer of very dark grayish brown loamy

sand about 9 inches thick. The subsurface layer is grayish brown sand about 4 inches thick. The next part is dark reddish brown and strong brown, loose sand about 12 inches thick, and below that is light yellowish brown, loose sand about 5 inches thick. The lower part, about 4 inches thick, is yellowish brown, friable loam. The substratum to a depth of 60 inches is yellowish brown, calcareous loam.

The soils in this association are used mainly as cropland. Corn is the most commonly grown crop. In a few areas, these soils are used as pasture or woodland.

The Londo and Parkhill soils are well suited to use as cropland and pasture. Wetness and maintaining good soil tilth are management concerns on these soils. The Wixom soils are moderately well suited to crops and well suited to pasture. Soil blowing is a hazard on Wixom soils, and wetness and low content of organic matter are management concerns. Grazing on the Londo and Parkhill soils when they are wet can cause surface compaction.

The Londo and Parkhill soils are well suited and the Wixom soils are moderately well suited to use as woodland. Windthrow, plant competition, seedling mortality, and equipment limitations are management concerns.

The Londo and Wixom soils have medium potential for use as septic tank absorption fields and building sites because of wetness and moderately slow or moderate permeability. The Parkhill soils have low potential for use as septic tank absorption fields and building sites because of wetness and moderately slow permeability.

7. Ithaca-Ziegenfuss Association

Nearly level and undulating, somewhat poorly drained and poorly drained loamy soils; on till plains

The Ithaca soils are in broad, flat areas, and the Ziegenfuss soils are lower on the landscape and along drainageways. The slope is 0 to 3 percent.

This association makes up about 4 percent of the survey area. It is about 73 percent Ithaca and similar soils, 17 percent Ziegenfuss and similar soils, and 10 percent soils of minor extent.

The Ithaca soils are somewhat poorly drained. They have a surface layer of dark brown loam about 10 inches thick. The next layer, about 4 inches thick, is mixed, dark brown clay loam and brown, mottled loam. The subsoil, about 16 inches thick, is dark brown, mottled clay loam. The substratum to a depth of 60 inches is brown, mottled, calcareous clay loam.

The Ziegenfuss soils are poorly drained. They have a surface layer of very dark gray loam about 9 inches thick. The mottled, clay subsoil is about 25 inches thick. It is dark gray and firm in the upper part, and gray and firm in the lower part. The substratum to a depth of about 60 inches is gray, calcareous clay loam.

Of minor extent are the well drained Perrinton soils on knolls and ridges and the somewhat poorly drained, sandy Selfridge soils on low knolls and ridges.

The soils in this association are used mainly as cropland. Corn is the most commonly grown crop. In a few areas, these soils are used as pasture and woodland.

These soils are well suited to use as cropland and pasture. Overcoming wetness and maintaining tilth are management concerns. Use of these soils for grazing when they are too wet can cause surface compaction.

The Ithaca soils are well suited and the Ziegenfuss soils are poorly suited to use as woodland. Windthrow, plant competition, seedling mortality, and equipment limitations are management concerns.

The Ithaca soils have medium potential for use as septic tank absorption fields and building sites because of wetness and moderately slow permeability. Ziegenfuss soils have low potential for use as septic tank absorption fields and building sites because of wetness and slow permeability.

8. Londo-Parkhill Association

Nearly level, somewhat poorly drained and poorly drained loamy soils; on till plains

The Londo soils are on broad, flat areas, and the Parkhill soils are in depressions and along drainageways. The slope is 0 to 3 percent.

This association makes up about 5 percent of the survey area. It is about 46 percent Londo and similar soils, 32 percent Parkhill and similar soils, and 22 percent soils of minor extent.

The Londo soils are somewhat poorly drained. They have a surface layer of very dark grayish brown loam about 9 inches thick. The next layer, about 5 inches thick, is mixed, yellowish brown loam and light yellowish brown, mottled sandy loam; the subsoil, about 8 inches thick, is dark yellowish brown clay loam. The substratum is grayish brown and brown, mottled, calcareous loam.

The Parkhill soils are poorly drained. They have a surface layer of dark grayish brown loam about 9 inches thick. The subsoil, about 26 inches thick, is grayish brown, mottled loam. The substratum is grayish brown, mottled, calcareous loam.

Of minor extent are the somewhat poorly drained, sandy Selfridge soils in positions on the landscape similar to those of the Londo soils. The well drained Guelph soils are on knolls and ridges, and the very poorly drained, alluvial Cohoctah soils are on the flood plains of streams and rivers.

The soils in this association are used mainly as cropland. Dry beans are the most commonly grown crop. In a few areas, they are used as pasture or woodland.

These soils are well suited to use as cropland and pasture. Overcoming wetness and maintaining good soil tilth are management concerns. Use of these soils for

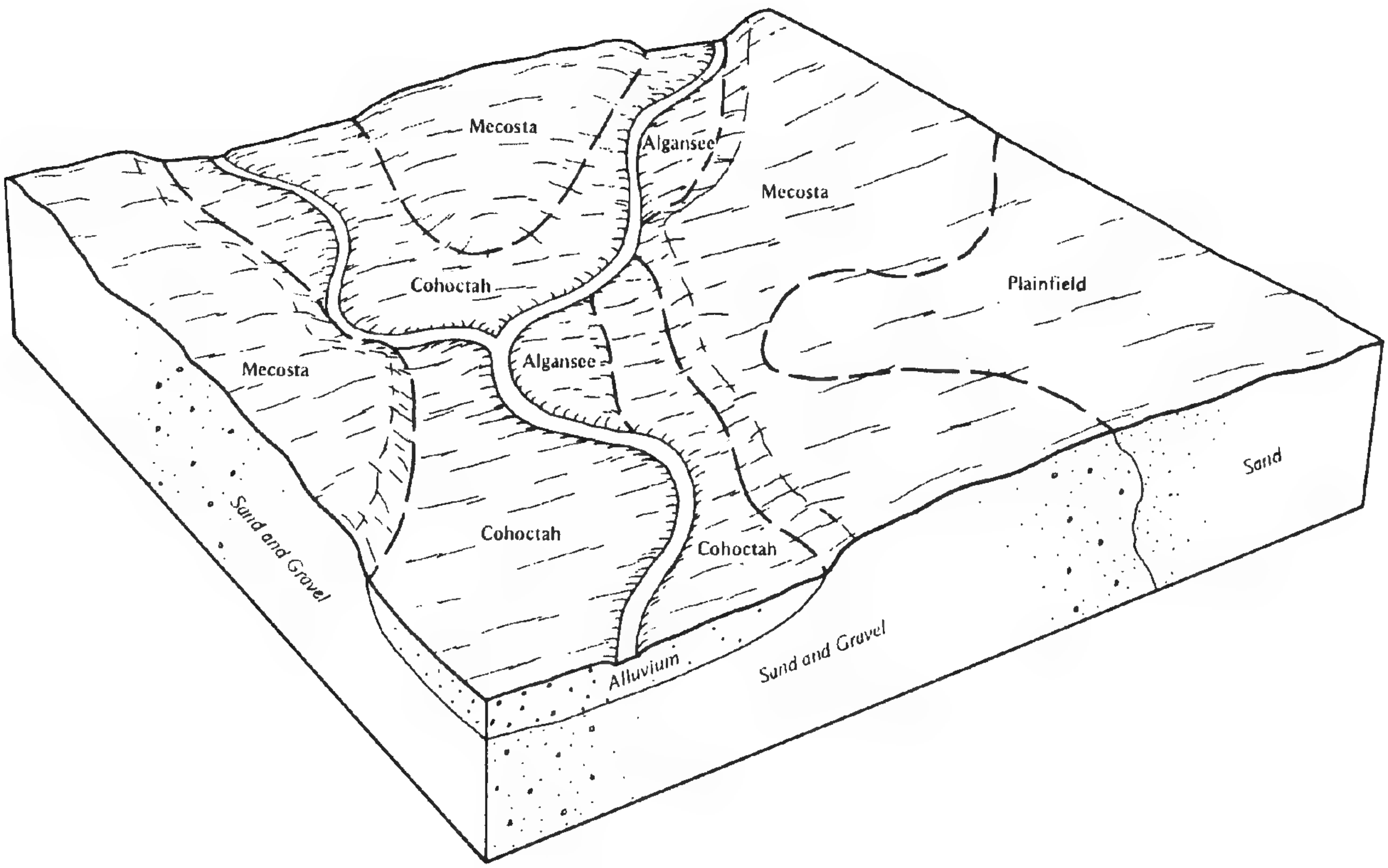

Figure 6.—Typical pattern of soils and underlying material in the Mecosta-Cohoctah association.

grazing when they are wet can cause surface compaction.

These soils are well suited to use as woodland. Windthrow, equipment limitations, seedling mortality, and plant competition are management concerns.

The Londo soils have medium potential for use as septic tank absorption fields and building sites because of wetness and moderately slow or moderate permeability. The Parkhill soils have low potential for use as septic tank absorption fields and building sites because of wetness and moderately slow permeability.

Nearly level to hilly, somewhat excessively drained, poorly drained, and very poorly drained soils

These soils are used mainly as woodland. In some areas, these soils are in pasture. The soils are poorly suited to crops. They have a wide range in suitability for use as woodland or pasture.

The soils have high or low potential for use as septic tank absorption fields and building sites. Wetness, flooding, ponding, slope, and poor filtering capacity of the soils are limitations.

9. Mecosta-Cohoctah Association

Nearly level, somewhat excessively drained and poorly drained sandy and loamy soils; on stream terraces, outwash plains, and flood plains

The soils in this association are in and adjacent to old glacial drainageways. The Mecosta soils are on the narrow outwash plains and are commonly bordered by escarpments on the side nearest the flood plains. The Cohoctah soils are on the flood plains (fig. 6). The slope is 0 to 3 percent.

This association makes up about 2 percent of the survey area. It is about 35 percent Mecosta and similar soils, 25 percent Cohoctah and similar soils, and 40 percent soils of minor extent.

The Mecosta soils are somewhat excessively drained. They have a surface layer of very dark grayish brown sand about 9 inches thick. The subsoil is about 30

inches thick. In the upper part it is strong brown, loose sand; in the middle part it is dark brown, very friable, gravelly loamy sand; and in the lower part it is dark yellowish brown, loose, gravelly sand and yellowish brown, loose, very gravelly sand. The substratum to a depth of 60 inches is yellowish brown, calcareous, extremely gravelly sand.

The Cohoctah soils are poorly drained. They have a surface layer of very dark grayish brown fine sandy loam about 10 inches thick. The subsurface layer is dark grayish brown, mottled fine sandy loam about 3 inches thick. The substratum extends to a depth of 60 inches or more. It is pale brown, mottled loamy fine sand in the upper part; dark brown, mottled fine sandy loam in the middle part; and brown and dark grayish brown, mottled sand in the lower part.

Of minor extent are the excessively drained Plainfield soils and the well drained Ormas soils in positions on the landscape similar to those of the Mecosta soils. The somewhat poorly drained Pipestone and Wasepi soils are slightly lower on the landscape than the Mecosta soils. The somewhat poorly drained Algansee soils and the very poorly drained Pinnebog soils are in positions on the landscape similar to those of the Cohoctah soils.

In most areas, the soils in this association have a cover of natural vegetation, commonly trees. The soils are used mainly as recreation areas and as wildlife habitat. In places, they are used as cropland and permanent pasture. Corn is the most commonly grown crop.

The soils are moderately well suited to use as woodland. Plant competition, seedling mortality, and equipment limitations are management concerns. Windthrow is a hazard on the Cohoctah soils.

The soils generally are not suited or are poorly suited to use as cropland. Flooding is a hazard on the Cohoctah soils. Soil blowing, droughtiness, and low content of organic matter are management concerns on the Mecosta soils.

The Mecosta soils are well suited to pasture. Conserving soil moisture is a management concern. The Cohoctah soils are poorly suited to pasture. Flooding and wetness are management concerns.

The Mecosta soils have high potential for use as septic tank absorption fields and building sites. Their poor filtering capacity, however, is a limitation for septic tank absorption fields. The Cohoctah soils have very low potential for use as septic tank absorption fields because of flooding, wetness, and rapid permeability. The Cohoctah soils have low potential for use as building sites because of flooding and wetness.

10. Coloma-Pinnebog Association

Nearly level to hilly, somewhat excessively drained and very poorly drained sandy and mucky soils; on outwash plains and in upland drains and depressions

These soils are in and adjacent to old glacial drainageways. The Coloma soils are on outwash plains. The Pinnebog soils are along drainageways. The slope is dominantly 0 to 12 percent, but ranges to 25 percent.

This association makes up about 12 percent of the survey area. It is about 64 percent Coloma and similar soils, 16 percent Pinnebog and similar soils, and 20 percent soils of minor extent.

The Coloma soils are somewhat excessively drained. They have a surface layer of dark brown sand about 11 inches thick. The subsurface layer is yellowish brown sand about 30 inches thick. The next part to a depth of more than 60 inches is light yellowish brown loose sand that has 1/8- to 1/4-inch thick textural bands of strong brown, very friable loamy sand.

The Pinnebog soils are very poorly drained. They have a surface layer of black muck about 11 inches thick. The underlying tiers to a depth of more than 60 inches are black and very dark gray muck and dark reddish brown mucky peat.

Of minor extent are the somewhat poorly drained Algansee soils that are slightly higher on the landscape than the Pinnebog soils. The poorly drained Cohoctah soils are in positions on the landscape similar to those of the Pinnebog soils. The somewhat poorly drained Thetford and Wasepi soils are in slightly lower positions on the outwash plains than the Coloma soils.

In most areas, the soils in this association have a cover of natural vegetation, commonly trees. The soils are used mainly as recreation areas and as wildlife habitat. In places, they are used as cropland and pastureland. Corn is the most commonly grown crop.

The soils are well suited or moderately well suited to use as woodland. Plant competition, seedling mortality, and equipment limitations are management concerns. Windthrow is a hazard on the Pinnebog soils.

The soils generally are not suited to cropland. However, in some larger areas of the Pinnebog soils, drainage makes them moderately well suited to crops, especially specialty crops. Wetness, subsidence, and equipment limitations are management concerns on the Pinnebog soils. Areas of Coloma soils that have slopes of less than 12 percent can be used as cropland. Conserving soil moisture and increasing the content of organic matter are management concerns on these Coloma soils. Soil blowing is a hazard on both of these soils.

The Coloma soils in which slope is less than 12 percent are well suited to use as pasture; but Coloma soils of more than 12 percent slope are poorly suited to this use. Conserving soil moisture is a management concern. The Pinnebog soils are poorly suited to use as pasture. Overcoming wetness and preventing surface compaction are management concerns.

The Coloma soils have high potential for use as septic tank absorption fields and building sites. Their poor filtering capacity, however, is a limitation for septic tank

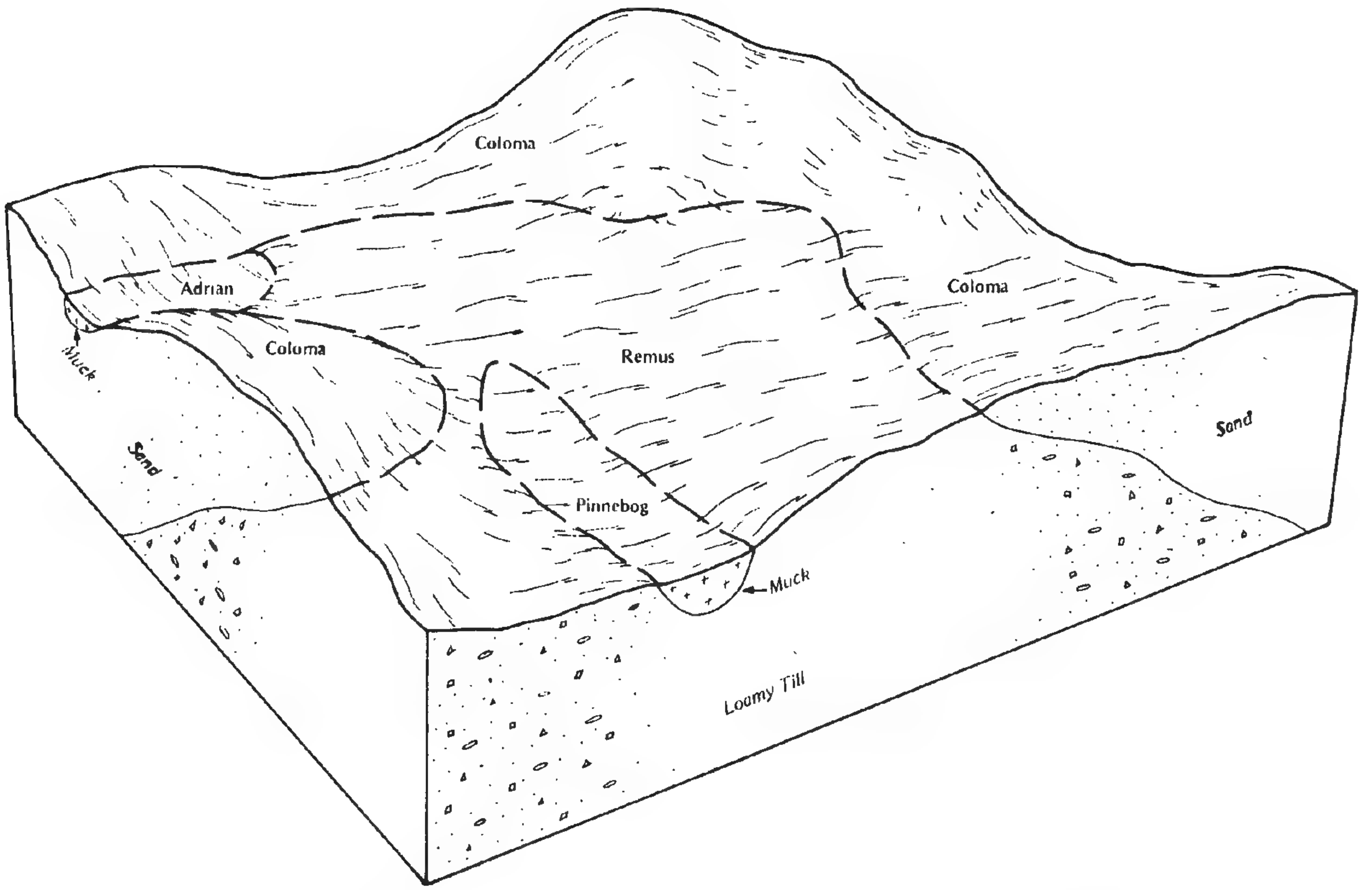

Figure 7.—Typical pattern of soils and underlying material in the Coloma-Remus association.

absorption fields. The Pinnebog soils have very low potential for these uses because of ponding, wetness, and low strength.

Nearly level to steep, somewhat excessively drained and well drained soils

Most of these soils are in woodland. They are well to moderately well suited to use as woodland or pasture, and poorly suited to use as cropland.

These soils have high potential for use as septic tank absorption fields and building sites. The poor filtering capacity of the sandy soils and the rolling, hilly, steep, or very steep slopes are limitations to these uses.

11. Coloma-Remus Association

Nearly level to steep, somewhat excessively drained and well drained sandy and loamy soils; on moraines, till plains, and kames

The Coloma and Remus soils are in broad upland areas on hills and high ridges (fig. 7). The slope ranges from 0 to 45 percent.

This association makes up about 2 percent of the survey area. It is about 62 percent Coloma and similar soils, 23 percent Remus and similar soils, and 15 percent soils of minor extent.

The Coloma soils are somewhat excessively drained. They have a surface layer of dark brown sand about 11 inches thick. The subsurface layer is yellowish brown sand about 30 inches thick. The next part to a depth of more than 60 inches is light yellowish brown, loose sand that has 1/8- to 1/4-inch thick textural bands of strong brown, very friable loamy sand.

The Remus soils are well drained. They have a surface layer of dark brown fine sandy loam about 9 inches thick. The next part, about 29 inches thick, is mixed, dark yellowish brown loam and brown loam. The subsoil is about 14 inches thick. It is dark yellowish brown loam in the upper part and dark brown sandy

loam in the lower part. The substratum is brown, calcareous loam.

Of minor extent are the very poorly drained Adrian and Pinnebog soils in bogs and depressions.

In most areas the soils in this association have a cover of natural vegetation, commonly trees. The soils are used mainly as recreation areas and wildlife habitat. In places, they are used as cropland and pasture. Corn is the most commonly grown crop.

Crop production is generally not practical on these soils because of the steepness of the slope. However, in some of the larger areas of Remus soil, where slope ranges from 1 to 6 percent, this soil is suited to cropland.

The soils are suited to use as pasture. Conserving soil moisture is a management concern on the Coloma soils.

The soils are well suited to use as woodland. Plant competition, equipment limitations, seedling mortality, and water erosion are management concerns.

Areas of this association where slope is less than 18 percent have high potential for use as septic tank absorption fields and building sites. However, the poor filtering capacity of the Coloma soils and moderate permeability of the Remus soils are limitations for septic tank absorption fields. In areas where slope is greater than 18 percent, the soils in this association have medium potential for septic tank absorption fields and building sites. The hilly to very steep slopes are limitations for these uses.

Nearly level to gently rolling, very poorly drained, somewhat poorly drained and well drained soils

Most areas of these soils are in woodland, and they are fairly well suited to this use. Equipment limitations and windthrow are management concerns. The sandy soils are moderately well suited to use as cropland, and the mucky soils are generally not suited to this use. Soil blowing, water erosion, droughtiness, and wetness are management concerns.

The sandy soils of this group have high or medium potential for use as septic tank absorption fields and building sites. Wetness, slope, and poor filtering capacity of the soil are limitations to these uses. The organic soils have very low potential for these uses. Ponding is a hazard, and wetness and low strength are limitations.

12. Adrian-Thetford-Spinks Association

Nearly level to gently rolling, very poorly drained, somewhat poorly drained, and well drained mucky and sandy soils; in upland drains and depressions and on outwash plains

The Spinks soils are in broad upland areas on knolls and ridges, the Thetford soils are on low knolls and ridges, and the Adrian soils are in depressions and along drainageways. The slope is 0 to 12 percent.

This association makes up about 4 percent of the survey area. It is about 31 percent Adrian and similar soils, 25 percent Thetford and similar soils, 17 percent Spinks and similar soils, and 27 percent soils of minor extent.

The Adrian soils are very poorly drained. The surface layer is black muck about 11 inches thick. The underlying tiers to a depth of about 26 inches are also black muck. The substratum extends to a depth of more than 60 inches. In the upper part it is dark gray and gray, calcareous sand; in the middle part it is stratified grayish brown, calcareous, very fine sand and silt; and in the lower part it is gray, calcareous, gravelly sand.

The Thetford soils are somewhat poorly drained. They have a surface layer of dark brown loamy sand about 10 inches thick. The subsurface layer is yellowish brown, mottled sand about 17 inches thick. The next part is about 11 inches thick. It is light yellowish brown, loose sand that has 1/4- to 3-inch textural bands of dark yellowish brown, mottled, very friable loamy sand. The substratum to a depth of more than 60 inches is yellowish brown, mottled sand.

The Spinks soils are well drained. They have a surface layer of dark brown sand about 9 inches thick. The subsurface layer is yellowish brown sand about 11 inches thick. Between depths of 20 and 60 inches are alternate bands of light yellowish brown sand and strong brown loamy sand.

Of minor extent are the somewhat poorly drained, loamy Londo soils on low knolls and ridges. The poorly drained Cohoctah soils are on flood plains along rivers and streams, and the very poorly drained Gilford soils are in depressions and along drainageways.

The soils in this association are used mainly as pasture and woodland. In a few areas, they are used as cropland. Corn is the most commonly grown crop.

Areas of the Thetford and Spinks soils in which slope is less than 12 percent are moderately well suited to use as cropland. Wind erosion is a hazard, and increasing the content of organic matter is a management concern. Wetness is a management concern on the Thetford soils, and water erosion is a hazard on the steeper slopes of the Spinks soils. The Adrian soils, if drained, are moderately well suited to use as cropland.

The Thetford and Spinks soils are well suited to use as pasture. Conserving soil moisture during dry summer months is a management concern. The Adrian soils are poorly suited to use as pasture. Wetness and surface compaction are management concerns.

The Spinks and Thetford soils are well suited to use as woodland. Seedling mortality and plant competition are management concerns. The Adrian soils are moderately well suited to use as woodland. Seedling mortality, plant competition, windthrow, and equipment limitations are management concerns on the Adrian soils.

The Spinks soils have high potential for use as septic tank absorption fields and building sites. The poor filtering capacity, however, is a limitation for septic tank

absorption fields. The Thetford soils have medium potential for use as septic tank absorption fields and building sites because of wetness. The Adrian soils have very low potential for septic tank absorption fields and building sites because of ponding, wetness, and low strength.

Broad Land Use Considerations

The soils in Isabella County vary widely in their suitability for major land uses.

Cropland and Pasture. About 42 percent of the land in the county is used as cropland. Corn, soybeans, and dry beans are the major crops. Although this cropland is scattered throughout the county, it is concentrated in associations 1, 2, 3, 4, 6, 7, and 8. The soils in these associations are suited to crops.

Associations 1, 2, and 3 are on nearly level to gently rolling uplands. Controlling the hazards of water erosion and soil blowing, reducing soil wetness, and maintaining good soil tilth are the main management concerns in these associations. In associations 4, 6, 7, and 8, crops are grown mainly on the nearly level to undulating upland soils. Reducing soil wetness and maintaining good soil tilth are the main management concerns in these associations.

The very poorly drained organic soils in associations 10 and 12 are generally not cultivated. However, some of the larger organic areas have been cleared and drained and are suited to crops, such as corn, and to specialty crops, such as mint and celery. Wetness, soil blowing, subsidence after drainage, and equipment limitations associated with soil stability are the main management concerns.

Pasture and Hayland. The soils in associations 5, 11, and 12 generally are suited to permanent pasture. The soils in association 11 generally are eroded, and many of the soils are low in natural fertility. Some of the wet soils in association 12 are also used as pasture. Grazing when the soils are wet causes soil compaction, which can result in decreased growth of pasture. The productivity of a pasture is influenced by the number of livestock it supports, the length of time they graze, and rainfall distribution. Good pasture management includes controlled stocking rates, pasture rotation, deferred grazing, grazing at the proper season, and supplying water at strategic locations for livestock.

Woodland. About 30 percent of the county is in woodland. The productivity is high on the upland soils in associations 1, 2, 3, 4, 5, 8, and 11; moderately high and high on the soils in associations 6, 9, 10, and 12; and low and high in association 7. Plant competition is the main concern on soils used for woodland in Isabella County. Erosion, equipment limitations, seedling mortality, and windthrow are additional management concerns on many soils.

Recreation. The soils in Isabella County range from poorly suited to well suited to use as sites for recreation, depending on the intensity of expected use. Most of the soils in associations 2, 3, 4, 6, 7, and 8 are generally suited to intensive recreation uses, such as playgrounds, camp areas, picnic areas, and paths and trails. Wetness is a limitation to these uses on the very poorly drained organic soils in associations 10 and 12 and on the somewhat poorly drained soils in associations 2, 3, 6, 7, 8, and 12. The sandy texture of the well drained soils in associations 1, 4, 10, 11, and 12 is a limitation to these uses.

Wildlife Habitat. The suitability of the soils for use as wildlife habitat is generally high throughout the county. The soils in associations 1, 2, 3, 4, 5, 6, 7, 8, 10, and 11 are generally suited to use as habitat for openland and woodland wildlife. The very poorly drained organic soils in associations 10 and 12 and the somewhat poorly drained and poorly drained soils in associations 3, 5, 6, 7, 8, 9, and 12 are suited to use as habitat for wetland wildlife.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, wetness, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Coloma sand, 6 to 12 percent slopes, is one of several phases in the Coloma series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Remus-Spinks complex, 6 to 12 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Histosols and Aquents is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, gravel, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

10—Pinnebog muck. This is a nearly level, very poorly drained soil in bogs, drainageways, and other depressional areas. This soil is subject to ponding. Individual areas are irregular in shape and range in size from 3 to 240 acres or more.

Typically, the surface layer is black muck about 11 inches thick. The underlying tiers, to a depth of about 60 inches, are black and very dark gray muck and dark reddish brown mucky peat. In places, there is less than 10 inches of mucky peat or more than 2 inches of sedimentary peat in the underlying tiers. In places, the organic tiers are more acid.

Permeability is moderately slow to moderately rapid. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface from autumn to early summer.

Most areas of this soil support cattails, water-tolerant grasses and sedges, or wetland tree species. A few areas are used as pasture, and a few drained areas are used as cropland.

This soil is generally not suited to use as cropland or pasture. However, if this soil can be drained and if it is

protected from soil blowing, it is moderately well suited to such crops as corn or to specialty crops, such as mint.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, windthrow, equipment limitations, seedling mortality, and plant competition are management concerns. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. This soil is generally not suited to the use of ordinary crawler tractors or rubber-tired skidders because of wetness and low soil stability. Special equipment is needed to harvest wood products. Seedling losses may be high because of wetness. The rate of seedling survival can be improved by special site preparation, such as bedding before planting or applying herbicides. Special harvesting methods and site preparation also help control competition from undesirable plants.

This soil has very low potential for use as building sites and septic tank absorption fields. Overcoming the limitations caused by the ponding hazard, wetness, and poor soil strength is difficult and very costly (fig. 8).

The land capability classification of this soil is Vw, and the Michigan soil management group is Mc.

11B—Spinks sand, 0 to 6 percent slopes. This is a nearly level and undulating, well drained soil on knolls, ridges, and broad upland areas. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 640 acres or more.

Typically, the surface layer is dark brown sand about 9 inches thick. The subsurface layer is yellowish brown sand about 11 inches thick. The next part extends to a depth of 60 inches or more. It is light yellowish brown, loose sand that has 1/8- to 3-inch thick textural bands of strong brown, very friable loamy sand. In places, there are no textural bands, or the total accumulation of textural material is less than 6 inches thick. In some areas, the textural bands may contain clay. In places, there is gravelly sand in the substratum.

Included with this soil in mapping are small areas of the well drained Metea soils in positions on the landscape similar to those of the Spinks soil. The Metea soils have a loamy substratum and are less droughty than the Spinks soil. Also included are small areas of the somewhat poorly drained Thetford and Pipestone soils in depressions and on side slopes. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately rapid. The available water capacity is low. Surface runoff is very slow or slow.

Most areas of this soil are used as pasture and hay crops. A few areas are used as cropland or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, management concerns are increasing the organic matter content, conserving soil moisture during dry periods, and controlling soil blowing. The content of organic matter in the soil can be increased by conservation tillage and by supplemental additions of organic matter. These practices also help to increase the available water capacity of the soil. If water of sufficient quantity and quality is available, irrigation increases the available water of the soil. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface, cover crops, buffer strips, and field windbreaks help control soil blowing.

This soil is well suited to use as pasture. If this soil is used as pasture, conserving soil moisture during dry periods is a management concern. During summer months, moisture in this soil is commonly insufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, seedling mortality and plant competition are management concerns. Some seedling losses can be expected during dry summer months. Practices that help increase the survival rate of seedlings are the use of special planting stock and special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation help control competition from undesirable plants.

This soil has high potential for use as building sites and septic tank absorption fields. There are no major management concerns.

The land capability classification of this soil is IIIs, and the Michigan soil management group is 4a.

11C—Spinks sand, 6 to 12 percent slopes. This is a gently rolling, well drained soil on knolls, ridges, and broad upland areas. Individual areas of this unit are irregular in shape. They range in size from 3 to 20 acres or more.

Typically, the surface layer is dark brown sand about 7 inches thick. The subsurface layer is yellowish brown sand about 11 inches thick. The next part to a depth of about 60 inches is light yellowish brown, loose sand that has 1/8- to 3-inch thick textural bands of strong brown, very friable loamy sand. In places, there are no textural bands, or the total accumulation of textural material is less than 6 inches thick. In some areas, the textural bands contain more clay. In places, there is gravelly sand in the substratum.

Included with this soil in mapping are small areas of the well drained Metea soils in positions on the landscape similar to those of the Spinks soil. The Metea soils have a loamy substratum and are less droughty than the Spinks soil. Also included are small areas of the somewhat poorly drained Thetford and Pipestone soils in

Figure 8.—Installing culverts and raising road grades above the seasonal high water table help prevent road ponding. This area of Pinnebog soils is frequently ponded.

depressions and on side slopes. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately rapid. The available water capacity is low. Surface runoff is slow.

Most areas of this soil are used as pasture. A few areas are used as cropland or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, management concerns are controlling water erosion and soil blowing, increasing organic matter content, and conserving soil moisture during dry periods. Conservation tillage that does not

invert the soil and that leaves all or part of the crop residue on the surface and the use of close-growing crops in the cropping system help control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks help control soil blowing. The content of organic matter in the soil can be increased by conservation tillage and supplemental additions of organic matter to the soil. These practices also help to increase the available water capacity of the soil.

This soil is well suited to use as pasture. If this soil is used as pasture, controlling water erosion and conserving soil moisture during dry periods are management concerns. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion. During the summer months, moisture in this soil commonly is not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, seedling mortality and plant competition are management concerns. Some seedling losses can be expected during dry summer months. Practices that increase the survival rate of seedlings are the use of special planting stock and special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may help control competition from undesirable plants.

This soil has high potential for use as building sites and septic tank absorption fields. Slope is the major management concern. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be needed in some areas, and slopes should be stabilized to prevent erosion. In some places, septic tank absorption field distribution lines can be placed on the contour.

The land capability classification of this soil is IIIe and the Michigan soil management group is 4a.

11D—Spinks sand, 12 to 18 percent slopes. This is a rolling, well drained soil on high knolls and ridges. Individual areas of this soil are irregular in shape. They range in size from 3 to 60 acres or more.

Typically, the surface layer is dark brown sand about 6 inches thick. The subsurface layer is yellowish brown sand about 11 inches thick. The next part to a depth of more than 60 inches is light yellowish brown, loose sand that has 1/8- to 3-inch thick textural bands of strong brown, very friable loamy sand. In places, there are no textural bands, or the total accumulation of textural material is less than 6 inches thick. In some areas, the textural bands contain more clay. In places, there is gravelly sand in the substratum.

Included with this soil in mapping are small areas of the well drained Metea soils in positions on the landscape similar to those of the Spinks soil. The Metea soils have a loamy substratum and are less droughty than the Spinks soil. Also included are small areas of the somewhat poorly drained Thetford and Pipestone soils in depressions and on side slopes. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately rapid. The available water capacity is low. Surface runoff is medium.

Most areas of this soil are used as pasture. A few areas are used as woodland or cropland.

This soil is poorly suited to use as cropland, but such crops as corn, soybeans, small grains, and grasses and legumes can be grown. If this soil is used as cropland, management concerns are controlling water erosion and soil blowing, increasing organic matter content, conserving soil moisture during dry periods, and minimizing the equipment limitation associated with slope. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and the use of close growing crops in the cropping system help prevent erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks help control soil blowing. The content of organic matter in the soil can be increased by conservation tillage and supplemental additions of organic matter to the soil. These practices also help to increase the available water capacity of the soil. Farming on the contour minimizes the equipment limitation associated with slope and helps to control erosion.

This soil is moderately well suited to use as pasture. If this soil is used as pasture, management concerns are controlling water erosion, conserving soil moisture during dry periods, and overcoming equipment limitations associated with slope. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion. During the summer months, moisture content in this soil is commonly not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, seedling mortality and plant competition are management concerns. Some seedling losses can be expected during dry summer months. Practices that increase the survival rates of seedlings are the use of special planting stock and special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may help control competition from undesirable plants.

This soil has medium potential for use as building sites and septic tank absorption fields. Slope is the major management concern. Buildings constructed on this soil

should be designed to conform to the natural slope of the land. Land shaping may be needed in some areas. Land shaping and installing distribution lines across the slope are generally necessary for septic tank absorption fields to operate properly. Slopes should be stabilized to prevent erosion and the surfacing of effluent.

The land capability classification of this soil is IVe, and the Michigan soil management group is 4a.

12B—Coloma sand, 0 to 6 percent slopes. This is a nearly level and undulating, somewhat excessively drained soil on knolls, ridges, and broad upland areas. Individual areas of this soil are irregular in shape. The areas range from 3 to 480 acres or more.

Typically, the surface layer is dark brown sand about 11 inches thick. The subsurface layer is yellowish brown sand about 30 inches thick. The next part to a depth of more than 60 inches is light yellowish brown, loose sand that has 1/8- to 1/4-inch thick textural bands of strong brown, very friable loamy sand. In places, there are no textural bands, or the total accumulation of the material in the textural bands is more than 6 inches thick. In some areas, the solum is fine sand. In places, the pebble content of the solum is greater than 10 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Thetford and Wasepi soils in shallow depressions and drainageways and on side slopes. The included soils make up 0 to 10 percent of the map unit.

Permeability is rapid. The available water capacity is low. Surface runoff is very slow.

Most areas of this soil are used as woodland. A few areas are used as pasture or cropland.

This soil is poorly suited to use as cropland, but such crops as corn, soybeans, small grains, and grasses and legumes can be grown. If this soil is used as cropland, management concerns are increasing organic matter content, conserving soil moisture during dry periods, and preventing soil blowing. Practices that help increase the content of organic matter in the soil are conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and supplemental additions of organic matter. These practices also help to increase the available water capacity of the soil, as does irrigation if water of sufficient quantity and quality is available. Conservation tillage, cover crops, buffer strips, and field windbreaks help control soil blowing.

This soil is moderately well suited to use as pasture. If this soil is used as pasture, conserving soil moisture during dry periods is a management concern. During the summer months, moisture content in this soil is commonly insufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, seedling mortality is a management concern. Some seedling losses can be expected during dry summer months. Practices that increase the survival rate of seedlings are the use of special planting stock and special site preparation, such as furrowing before planting or applying herbicides.

This soil has high potential for use as building sites and septic tank absorption fields. The poor filtering capacity of the soil is the major concern if this soil is used for septic tank absorption fields. This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may allow effluent to pollute groundwater supplies. Seepage should be monitored by periodically testing local wells for contamination.

The land capability classification of this soil is IVs, and the Michigan soil management group is 5a.

12C—Coloma sand, 6 to 12 percent slopes. This is a gently rolling, somewhat excessively drained soil on knolls and ridges and broad upland areas. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 80 acres or more.

Typically, the surface layer is dark brown sand about 5 inches thick. The subsurface layer is yellowish brown sand about 30 inches thick. The next part to a depth of more than 60 inches is light yellowish brown, loose sand. It contains 1/8- to 1/4-inch thick textural bands of strong brown, very friable loamy sand. In places, there are no textural bands, or the total accumulation of material in the textural bands is more than 6 inches thick. In some areas, the solum is fine sand. In places, the pebble content of the solum is greater than 10 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Thetford and Wasepi soils in shallow depressions and drainageways and on side slopes. The included soils make up 0 to 10 percent of the map unit.

Permeability is rapid. The available water capacity is low. Surface runoff is slow.

Most areas of this soil are used as woodland. A few areas are used as pasture or cropland.

This soil is poorly suited to use as cropland, but such crops as corn, soybeans, small grains, and grasses and legumes can be grown. If this soil is used as cropland, increasing the organic matter content, conserving soil moisture during dry periods, and controlling water erosion and soil blowing are management concerns. The content of organic matter in the soil can be increased by conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and by supplemental additions of organic matter to the soil. The hazard of erosion can be reduced by the use of conservation tillage and by including close-growing crops in the cropping system. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation

tillage, cover crops, buffer strips, and field windbreaks help control soil blowing and increase the available water capacity of the soil.

This soil is moderately well suited to use as pasture. If this soil is used as pasture, management concerns are controlling water erosion and conserving soil moisture during dry periods. Maintaining an adequate plant cover by preventing overgrazing helps control surface runoff and erosion. During the summer months, moisture in this soil commonly is not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, management concerns are seedling mortality and plant competition. Some seedling losses can be expected during dry summer months. The survival rate of seedlings can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites and septic tank absorption fields. Slope is the major concern if this soil is used as building sites. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be needed in some areas.

This soil has high potential for use as septic tank absorption fields. Slope and the poor filtering capacity of the soil are the main limitations to this use. In some places, septic tank absorption field lines can be placed on the contour. Slopes may need to be stabilized to prevent erosion and the surfacing of effluent. This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may allow effluent to pollute groundwater supplies. Seepage should be monitored by periodically testing wells for contamination

The land capability classification of this soil is IVs, and the Michigan soil management group is 4a.

12D—Coloma sand, 12 to 18 percent slopes. This is a rolling, somewhat excessively drained soil on high knolls and ridges. Individual areas of this soil are irregular in shape. They range in size from 10 to 40 acres or more.

Typically, the surface layer is dark brown sand about 5 inches thick. The subsurface layer is yellowish brown sand about 30 inches thick. The next part to a depth of more than 60 inches is light yellowish brown, loose sand. It contains 1/8- to 1/4-inch thick textural bands of strong brown, very friable loamy sand. In places, there are no textural bands, or the total accumulation of material in the bands is more than 6 inches thick. In some areas, the solum is fine sand. In places, the pebble content of the solum is greater than 10 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Thetford and Wasepi soils in shallow depressions and drainageways and on side slopes. These included areas make up 0 to 10 percent of the map unit.

Permeability is rapid. The available water capacity is low. Surface runoff is medium.

Most areas of this soil are used as woodland. A few areas are used as pasture.

This soil is generally not suited to cultivated crops because of the low available water capacity in the soil and the hazards of water erosion and soil blowing.

This soil is poorly suited to use as pasture. If this soil is used as pasture, management concerns are overcoming water erosion, conserving soil moisture during dry periods, and reducing slope-related limitations on the use of equipment. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion. During the summer months, moisture in this soil is commonly not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, seedling mortality is a management concern. Some seedling losses can be expected during dry summer months. The survival rate of seedlings can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites and septic tank absorption fields. Slope is the main management concern if this soil is used as sites for buildings. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be needed in some areas.

This soil has medium potential for use as septic tank absorption fields. Slope and the poor filtering capacity of the soil are limitations to this use. Land shaping and installing the distribution lines across the slope are generally needed for the septic tank absorption fields to operate properly. Slopes may need to be stabilized to prevent erosion and the surfacing of effluent. This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity of the soil may allow effluent to pollute groundwater supplies. Seepage should be monitored by periodically testing wells for contamination.

The land capability classification of this soil is VIs, and the Michigan soil management group is 5a.

12E—Coloma sand, 18 to 25 percent slopes. This is a hilly, somewhat excessively drained soil on hills and ridges. Individual areas of this soil are irregular in shape. The areas range in size from 15 to 160 acres or more.

Typically, the surface is dark brown sand about 4 inches thick. The subsurface layer is yellowish brown sand about 30 inches thick. The next part to a depth of more than 60 inches is light yellowish brown, loose sand. It has 1/8- to 1/4-inch thick textural bands of strong brown, very friable loamy sand. In places, there are no textural bands, or the total accumulation of material in the textural bands is more than 6 inches thick.

Included with this soil in mapping are small areas of the somewhat poorly drained Thetford and Wasepi soils in shallow depressions and drainageways and on side slopes. The included soils make up 0 to 10 percent of the map unit.

Permeability is rapid. The available water capacity is low. Surface runoff is medium.

Most areas of this soil are used as woodland. A few areas are used as pasture.

This soil is generally not suited to use as cropland or pasture because of the hilly slopes, the low available water capacity, and the hazards of water erosion and soil blowing.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, management concerns are erosion, equipment limitations, and seedling mortality. Because of the hazard of erosion, skid trails and landings should be constructed on gentle grades. Engineering practices, such as constructing outsloping road surfaces, culverts, and drop structures, are needed to prevent water from collecting on roadways. The use of crawler and rubber-tired tractors can be unsafe because of the steep slopes. Special harvesting methods, such as yarding logs uphill with a cable, may be needed. Some seedling losses can be expected during dry summer months. The survival rate of seedlings can be improved by the use of special planting stock and by special site preparation, such as contour furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites. Slope is the major management concern if this soil is used for building sites. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be needed in some areas.

This soil has low potential for use as septic tank absorption fields. Slope and the poor filtering capacity of the soil are the major management concerns if this soil is used for septic tank absorption fields. Overcoming the slope limitation is difficult and expensive. Land shaping and installing distribution lines across the slope are generally necessary for septic tank absorption fields to operate properly. Slopes should be stabilized to prevent erosion and the surfacing of effluent. This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity of the soil may allow groundwater supplies to become polluted. Seepage should be monitored by periodically testing wells for contamination.

The land capability classification of this soil is VIIs, and the Michigan soil management group is 5a.

12F—Coloma sand, 25 to 45 percent slopes. This is a steep, somewhat excessively drained soil on hills and ridges. Individual areas of this soil are irregular in shape. The areas range in size from 20 to 160 acres or more.

Typically, the surface is dark brown sand about 2 inches thick. The subsurface layer is yellowish brown sand about 30 inches thick. The next part to a depth of more than 60 inches is light yellowish brown, loose sand. It has 1/8- to 1/4-inch thick textural bands of strong brown, very friable loamy sand. In places, there are no textural bands, or the total accumulation of material in the textural bands is more than 6 inches thick.

Included with this soil in mapping are small areas of the somewhat poorly drained Thetford and Wasepi soils in shallow depressions and drainageways and on side slopes. The included soils make up 0 to 10 percent of the map unit.

Permeability is rapid. The available water capacity is low. Surface runoff is rapid.

Most areas of this soil are used as woodland. A few areas are used as pasture.

This soil is generally not suited to use as cropland or pasture because of the steep slopes, the low available water capacity, and the hazards of water erosion and soil blowing.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, management concerns are erosion, equipment limitations, and seedling mortality. Because of the hazard of erosion, roads, skid trails, and landings should be constructed on gentle grades. Engineering practices, such as constructing outsloping road surfaces, culverts, and drop structures, are needed to prevent water from collecting on roadways. The use of crawler and rubber-tired tractors can be unsafe because of the steep slopes. Special harvesting methods, such as yarding logs uphill with a cable, may be needed. Some seedling losses can be expected during dry summer months. The survival rate of seedlings can be improved by the use of special planting stock and by special site preparation, such as contour furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has very low potential for use as building sites and septic tank absorption fields. Overcoming the limitation caused by slope is difficult and very expensive.

The land capability classification of this soil is VIIs, and the Michigan soil management group is 5a.

14B—Tekenink loamy fine sand, 2 to 6 percent slopes. This is an undulating, well drained soil on knolls, ridges, and broad upland areas. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 120 acres or more.

Typically, the surface layer is dark brown loamy fine sand about 11 inches thick. The subsurface layer is yellowish brown loamy fine sand about 5 inches thick. The next part, about 17 inches thick, is mixed, dark brown loam and brown loamy sand. The subsoil, about 13 inches thick, is strong brown sandy loam. The substratum to a depth of more than 60 inches is yellowish brown, calcareous sandy loam. In places, there is more clay in the subsoil, or the depth to the substratum is less than 40 inches.

Included with this soil in mapping are small areas of the well drained Spinks soils in positions on the landscape similar to those of the Tekenink soil. The Spinks soils have more sand in the subsoil and substratum and are more droughty than the Tekenink soil. Also included are small areas of the somewhat poorly drained Metamora soils in shallow depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderate. Available water capacity is moderate. Surface runoff is slow.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, management concerns are controlling water erosion and soil blowing, and increasing the content of organic matter in the soil. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps control water erosion by reducing surface crusting and increasing water infiltration. Including close-growing crops in the cropping system also helps control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks help control soil blowing. The content of organic matter in the soil can be increased by conservation tillage and supplemental additions of organic matter to the soil.

This soil is well suited to use as pasture. If this soil is used as pasture, water erosion is a management concern. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion.

This soil is well suited to use as woodland. If this soil is used as woodland, seedling mortality and plant competition are management concerns. Some seedling losses can be expected during dry summer months. The survival rate of seedlings can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites and septic tank absorption fields. There are no major management concerns and few limitations to buildings.

The land capability classification of this soil is IIe, and the Michigan soil management group is 3a.

14C—Tekenink loamy fine sand, 6 to 12 percent slopes. This is a gently rolling, well drained soil on knolls and ridges. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 20 acres or more.

Typically, the surface layer is dark brown loamy fine sand about 9 inches thick. The subsurface layer is yellowish brown loamy fine sand about 5 inches thick. The next part, about 17 inches thick, is mixed, dark brown loam and brown loamy sand. The subsoil, about 13 inches thick, is strong brown sandy loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous sandy loam. In places, there is more clay in the subsoil, or the depth to the substratum is less than 40 inches.

Included with this soil in mapping are small areas of the well drained Spinks soils in positions on the landscape similar to those of the Tekenink soil. The Spinks soils have more sand in the subsoil and substratum and are more droughty than the Tekenink soil. Also included are small areas of the somewhat poorly drained Metamora soils in shallow depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderate. Available water capacity is moderate. Surface runoff is medium.

Most areas of this soil are used as cropland or pasture. A few areas are used as woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, management concerns are controlling water erosion and soil blowing, and increasing the content of organic matter. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to control water erosion by reducing surface crusting, thus increasing the rate of water infiltration. The use of close-growing crops in the cropping system also helps control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks help to control soil blowing. Conservation tillage and supplemental additions of organic matter to the soil help to maintain or increase the content of organic matter in the soil.

This soil is well suited to use as pastureland. If this soil is used as pasture, water erosion is a management concern. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion.

This soil is well suited to use as woodland. If this soil is used as woodland, plant competition is a management concern. Special harvesting methods and site

preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites and septic tank absorption fields. Slope is the major management concern. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be needed in some areas. Land shaping and installing distribution lines across the slope may be necessary for the septic tank absorption fields to operate properly. Slopes should be stabilized to prevent erosion and surfacing of effluent.

The land capability classification of this soil is IIIe, and the Michigan soil management group is 3a.

15B—Plainfield sand, 0 to 6 percent slopes. This is a nearly level and undulating, excessively drained soil on knolls, ridges, and broad upland areas. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 1,000 acres or more.

Typically, the surface layer is very dark grayish brown sand about 7 inches thick. The subsoil is strong brown, loose sand about 14 inches thick. The substratum to a depth of about 60 inches is yellowish brown sand. In places, thin loamy sand textural bands are in the subsoil, or the pebble content of the subsoil and substratum is greater than 15 percent.

Included with this soil in mapping are small areas of the well drained Spinks soils and the moderately well drained Covert soils in positions on the landscape slightly lower than those of the Plainfield soil. The included soils make up 0 to 10 percent of the map unit.

Permeability is rapid. The available water capacity is low. Surface runoff is very slow.

Most areas of this soil are used as woodland or are in idle fields. A few areas are used as pasture or cropland.

This soil is poorly suited to use as cropland, but such crops as corn, small grains, and grass-legume hay can be grown. If this soil is used as cropland, management concerns are increasing the organic matter content, conserving soil moisture during dry periods, and controlling soil blowing. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and supplemental additions of organic matter help to increase the content of organic matter in the soil. Conservation tillage and the use of cover crops, buffer strips, and field windbreaks help to control soil blowing. These practices also help to increase the available water capacity of the soil, as does irrigation if water of sufficient quantity and quality is available.

This soil is moderately well suited to use as pasture. If this soil is used as pasture, conserving soil moisture during dry periods is a management concern. During the summer months, moisture in this soil commonly is not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, seedling mortality and plant competition are management concerns. Some seedling losses can be expected during dry summer months. The survival rate of seedlings can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting or applying herbicides.

This soil has high potential for use as building sites and septic tank absorption fields. Poor filtering capacity is the main concern if the soil is used as septic tank absorption fields. This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may allow effluent to pollute groundwater supplies. Seepage should be monitored by periodically testing wells for possible contamination.

The land capability classification of this soil is IVs, and the Michigan soil management group is 5.3a.

15C—Plainfield sand, 6 to 12 percent slopes. This is a gently rolling, excessively drained soil on knolls and ridges and in broad upland areas. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 100 acres or more.

Typically, the surface layer is dark brown sand about 5 inches thick. The subsoil is strong brown, loose sand about 14 inches thick. The substratum to a depth of about 60 inches is yellowish brown sand. In places, thin loamy sand textural bands are in the subsoil, or the pebble content of the subsoil and substratum is greater than 15 percent.

Included with this soil in mapping are small areas of the well drained Spinks soils and moderately well drained Covert soils in positions on the landscape slightly lower than those of the Plainfield soil. Also included are small areas of the somewhat poorly drained Thetford soils in shallow depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is rapid. The available water capacity is low. Surface runoff is slow.

Most areas of this soil are used as woodland or pasture. A few areas are in idle fields.

This soil is generally not suited to row crops because of the low available water capacity and the hazards of water erosion and soil blowing.

This soil is poorly suited to use as pasture. If this soil is used for pasture, management concerns are controlling water erosion and conserving soil moisture during dry periods. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion. During the summer months, moisture in the soil is commonly insufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing

should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used for woodland, seedling mortality and plant competition are management concerns. Some seedling losses can be expected during dry summer months. The survival rate of seedlings can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites. Slope is the major concern in areas used as sites for buildings. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be needed in some areas.

This soil has high potential for use as septic tank absorption fields. Slope and the poor filtering capacity of this soil are the main concerns in areas used for septic tank absorption fields. In some places, septic tank absorption field lines can be placed on the contour. This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. Slopes should be stabilized to prevent erosion and the surfacing of effluent. The poor filtering capacity may allow the effluent to pollute groundwater supplies. Seepage should be monitored by periodically testing wells for contamination.

The land capability classification of this soil is VIs, and the Michigan soil management group is 5.3a.

15D—Plainfield sand, 12 to 18 percent slopes. This is a rolling, excessively drained soil on high knolls and ridges. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 70 acres or more.

Typically, the surface layer is dark brown sand about 4 inches thick. The subsoil is strong brown loose sand about 14 inches thick. The substratum to a depth of about 60 inches is yellowish brown sand. In places, thin loamy sand textural bands are in the subsoil, or the pebble content of the subsoil and substratum is greater than 15 percent.

Included with this soil in mapping are small areas of the well drained Spinks soils and moderately well drained Covert soils, which are in positions on the landscape slightly lower than those of the Plainfield soil. Also included are small areas of the somewhat poorly drained Thetford soils in shallow depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is rapid. The available water capacity is low. Surface runoff is medium.

Most areas of this soil are used as woodland. A few areas are used as pasture.

This soil is generally not suited to use as cropland or pasture because of the low available water capacity of the soil and the hazards of water erosion and soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, seedling mortality and plant competition are management concerns. Some seedling losses can be expected during dry summer months. The survival rate of seedlings can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation help control undesirable plant competition.

This soil has medium potential for use as building sites and septic tank absorption fields. Slope is the major concern if areas of this soil are used for buildings. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be needed in some areas.

This soil has medium potential for use as septic tank absorption fields. Slope and the poor filtering capacity of the soil are the main management concerns. Land shaping and installation of distribution lines across the slope are generally needed for septic tank absorption fields to operate properly. This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity of this soil may allow the effluent to pollute groundwater supplies. Seepage should be monitored by periodically testing wells for contamination.

The land capability classification of this soil is VIIs, and the Michigan soil management group is 5.3a.

16A—Wasepi loamy sand, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges and broad upland plains. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 200 acres or more.

Typically, the surface layer is very dark grayish brown loamy sand about 10 inches thick. The yellowish brown, mottled subsoil is about 18 inches thick. It is friable sandy loam in the upper part and loose loamy sand in the lower part. The substratum to a depth of about 60 inches is brown, mottled fine sand, pale brown calcareous coarse sand, and grayish brown, calcareous gravelly sand. In places, there is more clay in the subsoil, or there are thin loamy sand textural bands in the subsoil. In places, the depth to the substratum is less than 20 inches or a loamy substratum is below 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Minoa soils in positions on the landscape similar to those of the Wasepi soil. The Minoa soils are stratified and have less gravel in the substratum than the Wasepi soil, and they do not become droughty during warm periods of the year. Also included are small areas of the poorly drained Gilford soils, which are in shallow depressions and drainageways, and small areas of the well drained

Ormas soils on ridge tops and the tops of knolls. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. The available water capacity is low. Surface runoff is very slow. The seasonal high water table is within a depth of 1 foot to 2 feet during winter and spring.

Most areas of this soil are used as cropland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, management concerns are increasing the organic matter content, conserving soil moisture during dry periods, removing excess water during wet periods, and controlling soil blowing. The organic matter content of the soil can be increased by conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and by supplemental additions of organic matter to the soil. These practices also help to increase the available water capacity of the soil. Combined surface and subsurface drainage systems help control wetness. Shallow surface ditches effectively remove surface water. Erosion control structures may be needed where the surface ditches enter other drainageways. If drainage outlets are available, subsurface drainage helps to lower the seasonal high water table. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing.

This soil is well suited to use as pasture. If this soil is used as pasture, removing excess water during wet periods and conserving soil moisture during dry periods are management concerns. Only those species of pasture plants that tolerate wetness should be planted. During summer months, moisture in this soil is commonly not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, management concerns are windthrow, equipment limitation, and plant competition. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Special harvesting methods and site preparation help control competition from undesirable plants.

This soil has medium potential for use as building sites because of wetness. If buildings with basements are constructed, the building site should be raised by the use of well compacted fill material. Maintenance of an artificial drainage system and the installation and maintenance of a sump pump may also be needed to control the wetness. Yard use may need to be restricted during wet periods.

This soil has medium potential for use as septic tank absorption fields because of wetness and the poor filtering capacity of the soil. If a septic tank disposal system is constructed, the absorption field site may have to be placed on suitable fill material. A clay barrier may also be needed to raise the site above the seasonal high water table and to prevent the surfacing of effluent.

The land capability classification of this soil is IIIs, and the Michigan soil management group is 4b.

17—Cohoctah fine sandy loam, frequently flooded. This is a nearly level, poorly drained soil on the flood plains of rivers and streams. This soil is frequently flooded by stream overflow for brief periods. Individual areas of this soil are irregular in shape or are long and narrow and are commonly bordered by escarpments on the upland side. The areas range in size from 10 to 100 acres or more.

Typically, the surface layer is very dark grayish brown fine sandy loam about 10 inches thick. The subsurface layer is dark grayish brown, mottled fine sandy loam about 3 inches thick. The substratum extends to a depth of 60 inches or more. It is pale brown, mottled loamy fine sand in the upper part; dark brown, mottled fine sandy loam in the middle part; and brown and dark grayish brown mottled sand in the lower part. In some areas, the surface layer is muck. In places, there is more clay in the substratum or there is more sand in the surface layer, subsurface layer, and upper part of the substratum.

Included with this soil in mapping are small areas, on low knolls and terraces, of the somewhat poorly drained Algansee and Shoals soils. Also included are small areas of very poorly drained Pinnebog and Adrian soils, which are in depressions. The included soils make up 0 to 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. The available water capacity is moderate. Surface runoff is very slow. The high water table is at a depth of 1 foot or less from autumn to spring.

Most areas of this soil are used as woodland. A few areas are used as pasture.

This soil is generally not suited to cultivated crops because it is frequently flooded by stream overflow.

This soil is poorly suited to use as pasture. If this soil is used as pasture, flooding and wetness are management concerns. Good surface drainage and restricted use during the flood season help minimize the flood hazard. Only those species of pasture plants that tolerate wetness should be planted.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, management concerns are windthrow, equipment limitations, seedling mortality, and plant competition. The windthrow hazard can be minimized by using harvesting methods that do not leave

the remaining trees standing alone or widely spaced. The use of planting or logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Seedling losses may be high because of wetness. Special site preparations, such as bedding before planting or applying herbicides, can help improve the rate of seedling survival. Special harvesting methods and site preparation help control competition from undesirable plants.

This soil has low potential for use as building sites and very low potential for use as septic tank absorption fields. Flooding, wetness, and the poor filtering capacity of the soil are the major concerns in management. Overcoming these limitations is difficult and very costly.

The land capability classification of this soil is Vw, and the Michigan soil management group is L-2c.

18B—Covert sand, 0 to 4 percent slopes. This is a nearly level and undulating, moderately well drained soil on low knolls and ridges and broad upland plains. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 240 acres or more.

Typically, the surface layer is black sand about 5 inches thick. The subsurface layer is brown sand about 5 inches thick. The subsoil is sand about 25 inches thick. The upper part is dark reddish brown, and the lower part is strong brown. The substratum to a depth of about 60 inches is brownish yellow, mottled sand. In places, there is no accumulation of iron, aluminum, and organic matter in the subsoil, or no mottles are present in the substratum.

Included with this soil in mapping are small areas of the somewhat poorly drained Pipestone soils on side slopes and in shallow depressions. The included soils make up from 0 to 15 percent of the map unit.

Permeability is rapid. The available water capacity is low. Surface runoff is very slow or slow. The seasonal high water table is at a depth of 2 to 3 1/2 feet during winter and spring.

Most areas of this soil are used as woodland. A few areas are used as pasture or cropland.

This soil is poorly suited to use as cropland, but such crops as corn, small grains, and grass-legume hay can be grown. If this soil is used as cropland, management needs are increasing organic matter content, conserving soil moisture during dry periods, and controlling soil blowing. The content of organic matter in the soil can be increased by conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and by supplemental additions of organic matter to the soil. Conservation tillage and the use of cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. These practices also help to increase the available water capacity of the soil, as does irrigation, if water of sufficient quantity and quality is available.

This soil is moderately well suited to use as pasture. If this soil is used as pasture, conserving soil moisture during dry periods is a management concern. During the summer months, moisture in this soil is commonly not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, seedling mortality and plant competition are management concerns. Some seedling losses can be expected during dry summer months. The rate of seedling survival can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation help control competition from undesirable plants.

This soil has medium potential for use as building sites. If buildings with basements are constructed, the building site should be raised by the use of well compacted fill material. Maintenance of an artificial drainage system and the installation and maintenance of a sump pump also help control the wetness. Yard use may need to be restricted during wet periods.

This soil has medium potential for use as septic tank absorption fields because of wetness and the poor filtering capacity of the soil. If a septic tank disposal system is constructed, the absorption field may have to be placed on suitable fill material and a clay barrier may be needed to raise the field above the seasonal high water table and prevent the surfacing of the effluent.

The land capability classification of this soil is IVs, and the Michigan soil management group is 5a.

19—Gilford fine sandy loam. This is a nearly level, very poorly drained soil in drainageways and depressions. This soil is subject to ponding. Individual areas of this soil are irregular in shape. The areas range from 3 to 640 acres or more.

Typically, the surface layer is very dark grayish brown fine sandy loam about 11 inches thick. The subsurface layer is very dark grayish brown and dark grayish brown sandy loam about 3 inches thick. The subsoil is about 10 inches thick. It is dark grayish brown and grayish brown, mottled, friable, gravelly sandy loam. The substratum extends to a depth of 60 inches or more. It is brown, mottled, calcareous sand in the upper part, and it is brown and dark grayish brown, calcareous, extremely gravelly sand in the lower part. In places, there is more clay in the subsoil. In some areas, the depth to the substratum is less than 20 inches, or there is a loamy substratum below a depth of 40 inches.

Included with this soil in mapping are small areas of the poorly drained Corunna and Lamson soils in positions on the landscape similar to those of the Gilford soil. Also included are small areas of the somewhat

poorly drained Wasepi soils on low knolls and ridges and along the edges of the map unit. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the soil and very rapid in the lower part. The available water capacity is low. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface during winter and spring.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, removing excess water and controlling soil blowing are management concerns. Artificial drainage is needed for optimum crop production. A combined surface and subsurface drainage system helps to control wetness. Shallow surface ditches effectively remove surface water if adequate drainage outlets are available. Erosion control structures may be needed where the surface ditches enter other drainageways. If drainage outlets are available, subsurface drainage helps to lower the high water table. Lift pumps may be needed in some areas. To prevent tile lines from becoming filled with fine sand, they should be protected by suitable material. Practices used to control soil blowing are conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface, and planting cover crops, buffer strips, and field windbreaks.

This soil is well suited to use as pasture. If this soil is used as pasture, controlling wetness during winter and spring and conserving soil moisture during dry periods are management concerns. Only those species of pasture plants that tolerate wetness should be planted. During summer months, moisture in this soil is commonly not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, management concerns are windthrow, equipment limitations, seedling mortality, and plant competition. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of planting or logging equipment is limited during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Seedling losses may be high because of wetness. Special site preparation, such as bedding before planting or applying herbicides, can help increase the survival rate of seedlings. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has low potential for use as building sites because of ponding. If buildings with basements are constructed, the building site should be raised by use of well compacted fill material. An artificial drainage system and the installation and maintenance of a sump pump commonly are needed to control wetness. Yard use may need to be restricted during wet periods.

This soil has low potential for use as septic tank absorption fields because of ponding and the poor filtering capacity of the soil. If a septic tank disposal system is constructed, the absorption field site may have to be placed on suitable fill material. A clay barrier is commonly needed to raise the field above the high water table and prevent the surfacing of the effluent. Corrective measures on this soil are expensive, and commonly some degree of limitation remains.

The land capability classification of this soil is IIIw, and the Michigan soil management group is 4c.

20A—Pipestone sand, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges and on broad plains. Individual areas of this soil are irregular in shape. The areas range from 3 to 800 acres or more.

Typically, the surface layer is black sand about 2 inches thick. The subsurface layer is light brownish gray, mottled sand about 2 inches thick. The mottled subsoil is sand about 27 inches thick. In the upper part, it is dark brown and very friable, and in the lower part, it is dark yellowish brown and loose. The substratum to a depth of about 60 inches is yellowish brown, mottled sand. In places, there is no accumulation of iron, aluminum, and organic matter in the subsoil. In some areas, a loamy substratum is below a depth of 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Minoa and Wixom soils in positions on the landscape similar to those of the Pipestone soil. The Minoa and Wixom soils are less droughty in the warm seasons. Also included are small areas of the poorly drained Kingsville and Belleville soils, which are in drainageways and depressions. Small areas of the moderately well drained Covert soils are also included. They are on ridgetops and the tops of knolls. The included soils make up 10 to 15 percent of the map unit.

Permeability is rapid. The available water capacity is low. Surface runoff is very slow or slow. The seasonal high water table is at a depth of 1/2 foot to 1 1/2 feet from autumn to late spring.

Most areas of this soil are used as woodland. A few areas are used as pasture or cropland.

This soil is poorly suited to use as cropland, but such crops as corn, winter wheat, and grass hay can be grown. If this soil is used as cropland, management concerns are removing excess water during wet periods, increasing organic matter content, controlling soil blowing, and conserving moisture during dry periods. A combined surface and subsurface drainage system helps control wetness. Shallow surface ditches effectively

remove surface water. Erosion control structures may be needed where the surface ditches enter other drainageways. Subsurface drainage also helps to lower the seasonal high water table. To prevent tile lines from becoming filled with fine sand, they should be protected by suitable material. Practices used to control soil blowing are conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface, cover crops, buffer strips, and field windbreaks. The content of organic matter in the soil can be increased by conservation tillage and supplemental additions of organic matter to the soil. These practices also help to increase the available water capacity of the soil.

This soil is moderately well suited to use as pasture. If this soil is used as pasture, management concerns are controlling wetness during the autumn, winter, and spring and conserving soil moisture during dry periods. Only those species of pasture plants that tolerate wetness should be planted. During the summer months, moisture in this soil is commonly not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, management concerns are windthrow, equipment limitation, and plant competition. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of logging equipment is limited during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen (fig. 9). Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites because of wetness. If buildings with basements are constructed, the building site should be raised by use of well compacted fill material. An artificial drainage system and the installation and maintenance of a sump pump commonly are needed to control the wetness. Yard use may need to be restricted during wet periods.

This soil has medium potential for use as septic tank absorption fields because of wetness and the poor filtering capacity of the soil. If a septic tank disposal system is constructed, the absorption field site may have to be placed on suitable fill material. A clay barrier may be needed to raise the field above the seasonal high water table and prevent the surfacing of effluent.

The land capability classification of this soil is IVw, and the Michigan soil management group is 5b.

21—Kingsville loamy sand. This is a nearly level, poorly drained soil in drainageways, depressions, and broad, low-lying areas. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 700 acres or more.

Typically, the surface is black loamy sand about 8 inches thick. The subsoil is multicolored loose sand about 22 inches thick. The substratum to a depth of about 60 inches is dark grayish brown sand. In places, the surface layer is muck or mucky sand, or it is more than 10 inches thick. In places, the subsoil is neutral or mildly alkaline, and in some areas, a loamy substratum is below a depth of 40 inches.

Included with this soil in mapping are small areas of the poorly drained Belleville and Lamson soils in positions on the landscape similar to those of the Kingsville soil. The Belleville soils have a loamy substratum, and the Lamson soils have a stratified loamy subsoil and substratum. If drained, these soils are not as droughty as the Kingsville soil. Also included are small areas of the somewhat poorly drained Pipestone and Thetford soils, which are on low knolls and ridges or along the edge of the mapped areas. The included soils make up from 5 to 15 percent of the map unit.

Permeability is rapid. The available water capacity is low. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface during winter and spring.

Most areas of this soil are used as woodland. A few areas are used as pasture or cropland.

This soil is poorly suited to use as cropland, but such crops as corn, winter wheat, and grass hay can be grown. If this soil is used as cropland, removing excess water, increasing organic matter content, conserving soil moisture during dry periods, and controlling soil blowing are management concerns. Artificial drainage is needed for optimum crop production. A combined surface and subsurface drainage system helps control wetness. Shallow surface ditches effectively remove surface water if drainage outlets are available. Lift pumps may be needed in some areas. Erosion control structures may be needed where the surface ditches enter other drainageways. To prevent tile lines from filling with fine sand, they should be protected by suitable material. Practices that increase the content of organic matter of the soil are conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and by supplemental additions of organic matter to the soil. These practices also help to increase the available water capacity of the soil. Practices used to control soil blowing are conservation tillage and planting cover crops, buffer strips, and field windbreaks.

This soil is moderately well suited to use as pasture. If this soil is used as pasture, management concerns are controlling wetness during winter and spring and conserving soil moisture during dry periods. Only those species of pasture plants that tolerate wetness should be planted. During the summer months, moisture in this soil is commonly not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help

Figure 9.—Delaying woodland operations until these Pipestone soils are frozen or relatively dry improves trafficability.

maintain production during dry periods. Overgrazing should be avoided, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, windthrow, equipment limitation, seedling mortality, and plant competition are management concerns. The windthrow hazard can be minimized by harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Seedling losses may be high because of wetness. Special site preparations, such as bedding before planting or applying herbicides, can increase the rate of seedling survival. Special harvesting methods and site preparation help control competition from undesirable plants.

This soil has low potential for use as building sites because of ponding. If buildings with basements are constructed, the building site should be raised by use of

well compacted fill material. Maintenance of an artificial drainage system and the installation and maintenance of a sump pump commonly are needed to control wetness. Yard use may need to be restricted during wet periods.

This soil has low potential for use as septic tank absorption fields because of ponding and the poor filtering capacity of the soil. If a septic tank disposal system is constructed, the absorption field site may need to be placed on suitable fill material. A clay barrier is commonly needed to raise the field above the high water table and to prevent the surfacing of effluent. Corrective measures on this soil are expensive, and commonly some degree of limitation remains.

The land capability classification of this soil is IVw, and the Michigan soil management group is 5c.

22B—Perrinton loam, 2 to 6 percent slopes. This is an undulating, well drained soil on knolls, ridges, and broad upland areas. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 520 acres or more.

Typically, the surface is dark brown loam about 11 inches thick. The next part, about 5 inches thick, is friable and mixed, dark brown clay loam and pale brown loam. The subsoil, about 20 inches thick, is dark yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous clay loam. In some areas, the upper part of the subsoil is absent or has been destroyed by plowing, or the depth to the substratum is less than 20 inches. In places, there is less clay in the subsoil.

Included with this soil in mapping are small areas of the somewhat poorly drained Ithaca soils and the poorly drained Ziegenfuss soils. The Ithaca soils are on low knolls and on side slopes, and the Ziegenfuss soils are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately slow. The available water capacity is high. Surface runoff is medium. The subsoil and substratum have moderate shrink-swell potential.

Most areas of this soil are used as cropland or pasture. A few areas are used as woodland.

This soil is well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, controlling water erosion and improving soil tilth are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps control the water erosion by reducing surface crusting and increasing water infiltration. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures can be used to prevent gullying. Tilling the soil at the proper moisture content prevents clods from forming and the soil from becoming compacted. It also helps to maintain good soil tilth, as do conservation tillage and supplemental additions of organic matter to the soil (fig. 10).

This soil is well suited to use as pasture. If this soil is used as pasture, soil compaction is a management concern. Overgrazing or grazing when this soil is too wet may cause surface compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to use as woodland. If this soil is used as woodland, plant competition is a management concern. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites. Shrink-swell potential is the main limitation to the use of this soil for buildings. Backfilling foundation trenches with suitable coarse material can prevent the shrinking and swelling of the soil from damaging the foundations of buildings.

This soil has medium potential for use as septic tank absorption fields. Moderately slow permeability is the main limitation to this use. Dual alternating absorption fields may be needed to overcome the limitation of permeability.

The land capability classification of this soil is IIe, and the Michigan soil management group is 1.5a.

22C—Perrinton loam, 6 to 12 percent slopes. This is a gently rolling, well drained soil on knolls and ridges and broad upland areas. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 160 acres or more.

Typically, the surface is dark brown loam about 9 inches thick. The next part, about 5 inches thick, is friable and mixed dark brown clay loam and pale brown loam. The subsoil, about 20 inches thick, is dark yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous clay loam. In some areas, the upper part of the subsoil is absent or has been destroyed by plowing, or the depth to the substratum is less than 20 inches. In places, there is less clay in the subsoil.

Included with this soil in mapping are small areas of the somewhat poorly drained Ithaca soils and the poorly drained Ziegenfuss soils. The Ithaca soils are on low knolls and side slopes, and the Ziegenfuss soils are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately slow in the subsoil and substratum. The available water capacity is high. Surface runoff is medium. The shrink-swell potential is moderate in the subsoil and substratum.

Most areas of this soil are used as cropland or pasture. A few areas are used as woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, controlling water erosion and maintaining soil tilth are management concerns.

Figure 10.—This area of Perrinton loam has poor tilth as a result of erosion and compaction.

Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to control water erosion by reducing surface crusting, thus increasing the rate of water infiltration. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures can help prevent gullying. Tilling the soil at the proper moisture content prevents clods from forming and the soil from becoming compacted. It also helps to maintain good soil tilth, as do conservation tillage and supplemental additions of organic matter to the soil.

This soil is well suited to use as pasture. If this soil is used as pasture, controlling water erosion and soil compaction are management concerns. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion. Overgrazing or grazing when this soil is too wet may cause surface compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to use as woodland. If this soil is used as woodland, plant competition is a management concern. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites and septic tank absorption fields. Slope and shrink-swell potential are the major concerns for buildings. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be needed in some areas. Slopes should be stabilized to prevent erosion. Backfilling the foundation trench with suitable coarse textured material can prevent the

shrinking and swelling of the soil from damaging the foundations of buildings.

This soil has medium potential for use as septic tank absorption fields because of slope and the moderately slow permeability of the soil. Dual alternating absorption fields placed on the contour may be needed to overcome the permeability limitation. Slopes should be stabilized to prevent the surfacing of effluent.

The land capability classification of this soil is IIIe, and the Michigan soil management group is 1.5a.

22D—Perrinton loam, 12 to 18 percent slopes. This is a rolling, well drained soil on high knolls and ridges. Individual areas of this soil are irregular in shape. They range in size from 3 to 40 acres or more.

Typically, the surface is dark brown loam about 7 inches thick. The subsoil is about 25 inches thick. The next part, about 5 inches thick, is friable and mixed dark brown clay loam and pale brown loam. The subsoil is dark yellowish brown, firm clay loam about 20 inches thick. The substratum to a depth of about 60 inches is yellowish brown, calcareous clay loam. In some areas, the upper part of the subsoil is absent or has been destroyed by plowing. In places, there is less clay in the subsoil.

Included with this soil in mapping are small areas of the somewhat poorly drained Ithaca soils and the poorly drained Ziegenfuss soils. The Ithaca soils are on low knolls and on side slopes, and the Ziegenfuss soils are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately slow. The available water capacity is high. Surface runoff is rapid. The shrink-swell potential is moderate in the subsoil and substratum.

Most areas of this soil are used as pasture. A few areas are used as cropland or woodland.

This soil is poorly suited to use as cropland, but such crops as corn, winter wheat, and grass-legume hay can be grown. If this soil is cultivated, management concerns are water erosion, soil tilth, and equipment limitations associated with slope. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to control water erosion by reducing surface crusting, thus increasing the rate of water infiltration. Including close-growing crops in the cropping system also prevents erosion. Tilling the soil at the proper moisture content prevents clods from forming and the soil from becoming compacted. It also helps to maintain good soil tilth, as do conservation tillage and supplemental additions of organic matter to the soil. Farming on the contour minimizes equipment limitations associated with slope.

This soil is moderately well suited to use as pasture. If this soil is used as pasture, water erosion, soil compaction, and equipment limitations associated with slope are management concerns. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion. Overgrazing or grazing when this soil is too wet may cause surface compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to use as woodland. If this soil is used as woodland, plant competition is a management concern. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites because of slope and shrink-swell potential. Buildings constructed on this soil can be designed to conform to the natural slope of the land. Land shaping commonly is needed in most areas. Slopes should be stabilized to prevent erosion. Backfilling the foundation trench with suitable coarse textured material can prevent shrinking and swelling of the soil from damaging the foundations of buildings.

This soil has low potential for use as septic tank absorption fields because of slope and the moderately slow permeability of the soil. Dual alternating absorption fields placed on the contour may be needed to overcome the limitations of permeability and slope. Slopes should be stabilized to help prevent the surfacing of effluent.

The land capability classification of this soil is IVe, and the Michigan soil management group is 1.5a.

23B—Ithaca loam, 0 to 4 percent slopes. This is a nearly level and undulating, somewhat poorly drained soil on low knolls and ridges and broad plains. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 2,000 acres or more.

Typically, the surface layer is dark brown loam about 10 inches thick. The next part, about 4 inches thick, is mixed, dark brown, mottled, firm clay loam and brown loam. The subsoil is dark brown clay loam about 16 inches thick. The substratum to a depth of about 60 inches is brown, mottled, calcareous clay loam. In some areas, the mixed layer beneath the surface layer is absent or has been destroyed by plowing. In places, the depth to the substratum is less than 20 inches, or there is less clay in the subsoil.

Included with this soil in mapping are small areas of the well drained Perrinton soils on knolls and ridgetops and small areas of the poorly drained Ziegenfuss soils, which are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately slow. The available water capacity is high. Surface runoff is slow or medium. The seasonal high water table is at a depth of 1 foot to 2 feet from autumn to spring. The shrink-swell potential is moderate in the subsoil and substratum.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

Figure 11.—No-till soybeans in an area of Ithaca loam. No-till improves tilth by reducing soil compaction on heavier soils.

This soil is well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, management concerns are removing excess water during wet periods and maintaining soil tilth (fig. 11). A combined surface and subsurface drainage system helps control wetness. Shallow surface ditches effectively remove surface water, and subsurface drainage helps to lower the seasonal high water table. Erosion control structures may be needed where the surface ditches enter other drainageways (fig. 12). Tilling the soil at the proper moisture content prevents clods from forming and the soil from becoming compacted. Conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface and supplemental addition of organic matter to the soil also help to maintain good soil tilth.

This soil is well suited to use as pasture. If this soil is used as pasture, wetness and soil compaction are management concerns. Only those species of pasture plants that tolerate wetness should be planted. Overgrazing or grazing this soil when it is too wet can cause soil compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to use as woodland. If this soil is used as woodland, windthrow, plant competition, and equipment limitation are management concerns. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of logging equipment is restricted during wet periods, but woodland operations

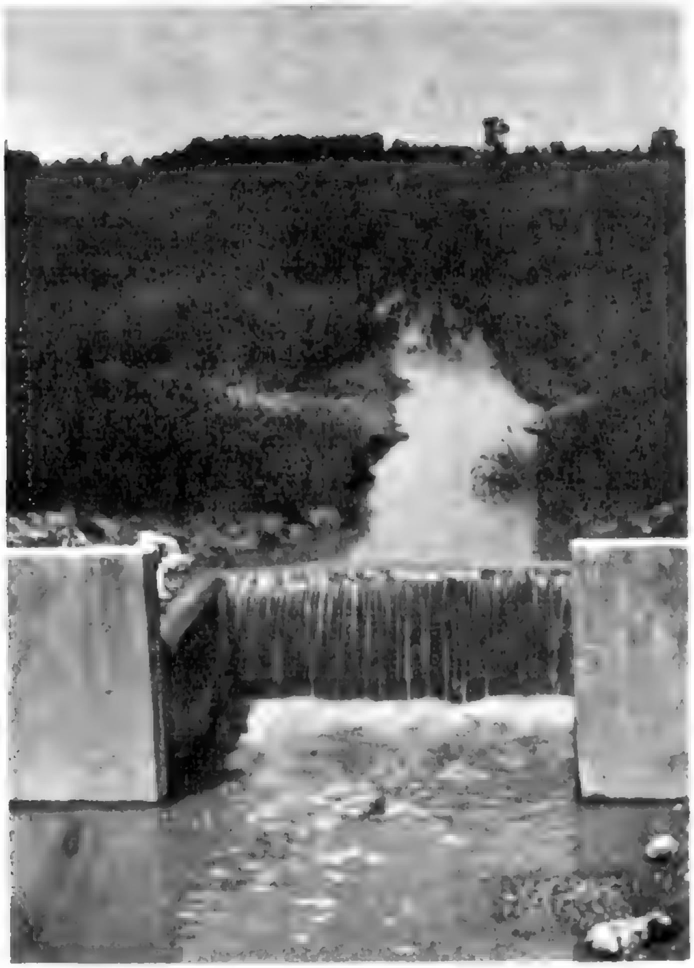

Figure 12.—This erosion control structure in an area of Ithaca and Perrinton soils safely carries surface water from the field into an open ditch. Perrinton soils are on the higher slopes in the background.

can be performed when the soil is relatively dry or frozen. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites because of wetness and shrink-swell potential. If buildings with basements are constructed, the building site should be raised, using well compacted, suitable fill material. Maintenance of an artificial drainage system and installation and maintenance of a sump pump may also be needed to overcome wetness. Yard use may need to be restricted during wet periods.

This soil has medium potential for use as septic tank absorption fields because of wetness and the moderately slow permeability of the soil. If a septic tank disposal system is constructed, the absorption field should be placed on suitable fill material. A clay barrier may be needed to raise the field above the seasonal high water table and to prevent the surfacing of effluent. Corrective measures on this soil are expensive, and commonly some degree of limitation remains.

The land capability classification of this soil is IIw, and the Michigan soil management group is 1.5b.

24—Ziegenfuss loam. This is a nearly level, poorly drained soil in drainageways and depressions. This soil is subject to ponding. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 100 acres or more.

Typically, the surface layer is very dark gray loam about 9 inches thick. The subsoil is mottled clay about 25 inches thick. The upper part is dark gray and firm, and the lower part is gray and firm. The substratum to a depth of about 60 inches is gray, calcareous clay loam. In places, the surface is more than 9 inches thick, or the depth to the substratum is more than 40 inches. In places, there is less clay in the subsoil.

Included with this soil in mapping are small areas of the poorly drained Corunna and Lamson soils in positions on the landscape similar to those of the Ziegenfuss soil. The Corunna soils have less clay in the subsoil than the Ziegenfuss soil. The Lamson soils have a stratified loamy subsoil and substratum. These soils are easier to drain than the Ziegenfuss soil. Also included are small areas of the somewhat poorly drained Ithaca and Londo soils on low knolls and ridges or along the edges of this map unit. The included soils make up from 5 to 15 percent of the map unit.

Permeability is slow. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface during winter and spring. The shrink-swell potential is moderate.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, management concerns are removing excess water and improving soil tilth. Artificial drainage is needed for optimum crop production. A combined surface and subsurface drainage system helps to control wetness. If drainage outlets are available, shallow surface ditches effectively remove surface water, and subsurface drainage helps lower the water table. Erosion control structures may be needed where the surface ditches enter other drainageways. Lift pumps may be needed in some areas. Tilling the soil at the proper moisture content prevents clods from forming and the soil from becoming compacted. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and supplemental additions of organic matter to the soil also help to maintain good soil tilth.

This soil is well suited to use as pasture. If this soil is used as pasture, wetness and soil compaction are management concerns. Only those species of pasture plants that tolerate wetness should be planted. Overgrazing or grazing when this soil is too wet can cause soil compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is poorly suited to use as woodland. If this soil is used as woodland, windthrow, equipment limitation, seedling mortality, and plant competition are management concerns. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of planting or logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Seedling losses may be high because of wetness. Using special site preparation, such as bedding before planting or applying herbicides, can help improve seedling survival. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has low potential for use as building sites because of ponding and shrink-swell potential. If buildings with basements are constructed, the building site should be raised, using well compacted fill material. Maintenance of an artificial drainage system and installation and maintenance of a sump pump commonly are needed to control wetness. Yard use may need to be restricted during wet periods. Backfilling foundation trenches with suitable coarse textured material can prevent the shrinking and swelling of the soil from damaging the foundations of buildings.

This soil has low potential for use as septic tank absorption fields because of slow permeability and ponding. If a septic tank disposal system is constructed, the absorption field should be placed on suitable fill material. A clay barrier may be needed to raise the field above the high water table and to prevent the surfacing of effluent. Corrective measures on this soil are expensive, and commonly some degree of limitation remains.

The land capability classification of this soil is IIw, and the Michigan soil management group is 1.5c.

25B—Wixom loamy sand, 0 to 4 percent slopes. This is a nearly level and undulating, somewhat poorly drained soil on low knolls and ridges and broad plains. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 60 acres or more.

Typically, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is grayish brown sand about 4 inches thick. The next part, about 12 inches thick, is dark reddish brown and strong brown, loose sand. The next part, about 5 inches thick, is light yellowish brown, loose sand. The lower part is yellowish brown, friable loam about 4 inches thick. The substratum to a depth of about 60 inches is yellowish brown, calcareous loam. In some areas, there is no accumulation of iron, aluminum, and organic matter in the subsoil. In places, the depth to the loamy part of the subsoil is less than 20 inches, and in other places, it is more than 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Thetford soils in positions on the landscape similar to those of the Wixom soil. The Thetford soils do not have a loamy substratum and are droughty during warm periods of the year. Also included are small areas of the poorly drained Belleville and Corunna soils, which are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is rapid in the upper part of the profile and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is very slow or slow. The seasonal high water table is at a depth of 1/2 foot to 1 1/2 feet during winter and spring. The shrink-swell potential of the loamy part of the subsoil and the substratum is moderate.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, management concerns are removing excess water during wet periods, locating drainage outlets, increasing organic matter content, maintaining soil tilth, and controlling soil blowing. A combined surface and subsurface drainage system helps to control wetness. Shallow surface ditches effectively remove surface water, and subsurface drainage helps to lower the seasonal high water table. Erosion control structures may be needed where the surface ditches enter other drainageways. To prevent tile lines from filling with fine sand, they should be protected by suitable material. The content of organic matter in the soil can be increased by conservation tillage that does not invert the soil and that leaves all or part of crop residue on the surface and by supplemental additions of organic matter to the soil. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing.

This soil is well suited to use as pasture. If this soil is used as pasture, wetness during winter and spring is a management concern. Only those species of pasture plants that tolerate wetness should be planted.

This soil is well suited to use as woodland. If this soil is used as woodland, windthrow, equipment limitations, and plant competition are management concerns. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of logging equipment is restricted during wet periods, but woodland operations

can be performed when the soil is relatively dry or frozen. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites because of wetness, poor filter, and shrink-swell potential. If buildings with basements are constructed, the building site should be raised, using well compacted, suitable fill material. Maintenance of an artificial drainage system and installation and maintenance of a sump pump may also be needed to control wetness. Yard use may need to be restricted during wet periods.

This soil has medium potential for use as septic tank absorption fields because of wetness and the moderately slow permeability of the soil. If a septic tank disposal system is constructed, the absorption field should be placed on suitable fill material. A clay barrier may be needed to raise the field above the seasonal high water table and to prevent the surfacing of effluent.

The land capability classification of this soil is IIIw, and the Michigan soil management group is 4/2b.

26A—Metamora fine sandy loam, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges and broad plains. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 120 acres or more.

Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. The mottled subsoil is about 24 inches thick. The upper part is dark brown, friable sandy loam; the next part is dark yellowish brown, very friable loamy sand; and the lower part is dark yellowish brown, friable clay loam. The substratum to a depth of about 60 inches is brown, mottled loam. In places, the loamy part of the subsoil is not present, or the subsoil is dark grayish brown or grayish brown. In some areas, the depth to the substratum is more than 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Selfridge soils in positions on the landscape similar to those of the Metamora soil. The Selfridge soils have more sand in the subsoil and are droughty during warm periods of the year. Also included are small areas of the poorly drained Parkhill and Corunna soils, which are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the profile and moderately slow in the lower part. The available water capacity is high. Surface runoff is slow. The seasonal high water table is at a depth of 1 foot to 2 feet during the winter and spring. The shrink-swell potential of the lower part of the subsoil and the substratum is moderate.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, removing excess water during wet periods, increasing organic matter content, and controlling soil blowing are management concerns. A combined surface and subsurface drainage system helps control wetness. Shallow surface ditches effectively remove surface water, and subsurface drainage helps to lower the seasonal high water table. Erosion control structures may be needed where the surface ditches enter other drainageways. The content of organic matter in the soil can be increased by conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and by supplemental additions of organic matter to the soil. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing.

This soil is well suited to use as pasture. If this soil is used as pasture, wetness during winter and spring is a management concern. Only those species of pasture plants that tolerate wetness should be planted.

This soil is well suited to use as woodland. If this soil is used as woodland, windthrow, plant competition, and equipment limitations are management concerns. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites because of wetness and shrink-swell potential. If buildings with basements are constructed, the building site should be raised, using well compacted, suitable fill material. Maintenance of an artificial drainage system and the installation and maintenance of a sump pump may also be needed. Yard use may need to be restricted during wet periods.

This soil has medium potential for use as septic tank absorption fields because of wetness and permeability. If a septic tank disposal system is constructed, the absorption field should be placed on suitable fill material. A clay barrier may be needed to raise the field above the seasonal high water table and to prevent the surfacing of effluent.

The land capability classification of this soil is IIw, and the Michigan soil management group is 3/2b.

27—Corunna sandy loam. This is a nearly level, poorly drained soil in drainageways, depressions, and broad, low-lying areas. This soil is subject to ponding. Individual areas are irregular in shape and range from 3 to 120 acres or more.

Typically, the surface layer is very dark grayish brown sandy loam about 11 inches thick. The subsoil is grayish

brown, mottled, very friable sandy loam about 22 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown and dark grayish brown, mottled, calcareous silty clay loam. In places, the depth to the substratum is more than 40 inches or less than 20 inches. In places, the surface layer and upper part of the subsoil are sand or loamy sand. In some areas, there is a 1- to 6-inch thick layer of gravelly sand above the substratum.

Included with this soil in mapping are small areas of the poorly drained Belleville soils in positions on the landscape similar to those of the Corunna soil. The Belleville soils have more sand in the subsoil than the Corunna soil and, if drained, become droughty during warm periods. Also included are small areas of the somewhat poorly drained Metamora and Londo soils on low knolls and ridges. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderate or moderately rapid in the upper part of the soil and moderately slow in the lower part. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface during winter and spring. The shrink-swell potential of the substratum is moderate.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, management concerns are removing excess water, increasing the organic matter content, and controlling soil blowing. Artificial drainage is needed for optimum crop production. A combined surface and subsurface drainage system helps control wetness. If drainage outlets are available, shallow surface ditches effectively remove surface water. Erosion control structures may be needed where the surface ditches enter other drainageways. If drainage outlets are available, subsurface drainage helps to lower the high water table. Lift pumps may be needed in some areas. The content of organic matter in the soil can be increased by conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and by supplemental additions of organic matter to the soil. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing.

This soil is well suited to use as pasture. If this soil is used as pasture, excess water is a management concern. Only those species of pasture plants that tolerate wetness should be planted.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, windthrow, equipment limitation, seedling mortality, and plant competition are management concerns. The windthrow hazard can be minimized by harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of planting or logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Seedling losses may be high because of wetness. Special site preparation, such as bedding before planting or applying herbicides, may improve the rate of seedling survival. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has low potential for use as building sites because of ponding, the high water table, and shrink-swell potential. If buildings with basements are constructed, the building site should be raised, using well compacted fill material. Maintenance of an artificial drainage system and the installation, use, and maintenance of a sump pump commonly are needed to control wetness. Yard use may need to be restricted during wet periods.

This soil has low potential for use as septic tank absorption fields because of moderately slow permeability in the soil, the high water table, and ponding. If a septic tank disposal system is constructed, the absorption field should be placed on suitable fill material. A clay barrier may be needed to raise the site above the high water table and to prevent the surfacing of effluent. Corrective measures on this soil are expensive, and commonly some degree of limitation remains.

The land capability classification of this soil is IIw, and the Michigan soil management group is 3/2c.

29A—Minoa loamy fine sand, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges and broad upland plains. Individual areas are irregular in shape. The areas range in size from 3 to 100 acres or more.

Typically, the surface layer is dark brown loamy fine sand about 10 inches thick. The mottled subsoil is about 28 inches thick. In the upper part, it is yellowish brown, very friable loamy fine sand. In the lower part, it is olive brown and yellowish brown, very friable, stratified loamy very fine sand, loamy fine sand, very fine sandy loam, and loam. The substratum to a depth of more than 60 inches is stratified brown and yellowish brown, very fine sand, silt, silt loam, and silty clay loam. In places, the depth to the substratum is more than 40 inches, or there is more clay in the subsoil and substratum.

Included with this soil in mapping are small areas of the somewhat poorly drained Thetford and Wasepi soils in positions on the landscape similar to those of the Minoa soil. The Thetford soils have more sand in the subsoil and substratum than the Minoa soil. The Wasepi soils have a sandy and gravelly substratum. These soils are droughty during warm periods of the year. Also included are small areas of the poorly drained Lamson and Kingsville soils, which are in depressions and drainageways. The included soils make up 10 to 20 percent of the map unit.

Permeability is moderate in the upper part of the profile and moderate or moderately rapid in the lower part. The available water capacity is high. Surface runoff is slow. The seasonal high water table is at a depth of 1 foot to 1 1/2 feet during the winter and spring.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, management concerns are removing excess water during wet periods, increasing organic matter, and controlling soil blowing. A combined surface and subsurface drainage system helps control wetness. Shallow surface ditches effectively remove surface water, and subsurface drainage helps to lower the seasonal high water table. Erosion control structures may be needed where the surface ditches enter other drainageways. To prevent tile lines from filling with fine sand, they should be protected by suitable material. The content of organic matter in the soil can be increased by conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and by supplemental additions of organic matter to the soil. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing.

This soil is well suited to use as pasture. If this soil is used as pasture, wetness during winter and spring is a management concern. Only those species of pasture plants that tolerate wetness should be planted.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, windthrow, seedling mortality, plant competition, and equipment limitations are management concerns. The windthrow hazard can be minimized by harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of planting or logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites. Wetness is the main limitation. If buildings with basements are constructed, the building site should be raised, using well compacted fill material. Maintenance of an artificial drainage system and the installation and maintenance of a sump pump may also be needed to control wetness. Yard use may need to be restricted during wet periods.

This soil has medium potential for use as septic tank absorption fields. The main limitation is wetness. If a septic tank disposal system is constructed, the absorption field should be placed on suitable fill material. A clay barrier may be needed to raise the site above the seasonal high water table and to prevent the surfacing of effluent.

The land capability classification of this soil is IIIw, and the Michigan soil management group is 3b-s.

30—Lamson fine sandy loam. This is a nearly level, poorly drained soil in drainageways and depressions and on broad, low-lying areas. This soil is subject to ponding. Individual areas are irregular in shape. The areas range in size from 3 to 160 acres or more.

Typically, the surface layer is very dark grayish brown, fine sandy loam about 11 inches thick. The mottled subsoil is about 21 inches thick. It is dark grayish brown and grayish brown, friable fine sandy loam. The mottled substratum to a depth of about 60 inches is olive brown loamy sand over stratified grayish brown, very fine sand and silt loam. In places, the depth to the substratum is less than 24 inches, and in places, there is more clay in the subsoil and substratum.

Included with this soil in mapping are small areas of the somewhat poorly drained Minoa soils on low knolls. Also included are small areas of the very poorly drained Gilford soils and the poorly drained Kingsville soils in positions on the landscape similar to those of the Lamson soil. If drained, the Gilford and Kingsville soils are droughty during warm periods of the year. The included soils make up 10 to 20 percent of the map unit.

Permeability is moderate or moderately rapid. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface during the winter and spring.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, removing excess water, locating drainage outlets, and controlling soil blowing are management concerns. A combined surface and subsurface drainage system helps control wetness. If drainage outlets are available, surface water can be removed by shallow surface ditches and the high water table can be lowered by subsurface drainage. Erosion control structures may be needed where the surface ditches enter other drainageways. Lift pumps may be needed in some areas. To prevent tile lines from filling with fine sand, they should be protected by suitable material. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing.

This soil is well suited to use as pasture. If this soil is used as pasture, wetness is a management concern. Only those species of pasture plants that tolerate wetness should be planted.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, windthrow, equipment limitations, seedling mortality, and plant competition are management concerns. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of planting or logging equipment is restricted during wet periods, but woodland operations can be

performed when the soil is relatively dry or frozen. Seedling losses may be high because of wetness. Special site preparation, such as bedding before planting or applying herbicides, can improve the rate of seedling survival. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has low potential for use as building sites because of ponding. If buildings with basements are constructed, the building site should be raised, using well compacted fill material. Maintenance of an artificial drainage system and the installation, use, and maintenance of a sump pump commonly are needed to control wetness. Yard use may need to be restricted during wet periods.

This soil has low potential for use as septic tank absorption fields because of ponding. If a septic tank disposal system is constructed, the absorption field should be placed on suitable fill material. A clay barrier is commonly needed to raise the site above the high water table and to prevent the surfacing of effluent. Corrective measures on this soil are expensive, and commonly some degree of limitation remains.

The land capability classification of this soil is IIIw, and the Michigan soil management group is 3c-s.

33A—Thetford loamy sand, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges and on broad plains. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 230 acres or more.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsurface layer is yellowish brown, mottled, loose sand about 17 inches thick. The next part is light yellowish brown loose sand about 11 inches thick. It has 1/4- to 3-inch thick textural bands of dark yellowish brown, mottled, very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, mottled sand. In places, the textural bands are not present, or the total accumulation of material in the textural bands is less than 6 inches. In places, there is an accumulation of iron, aluminum, and organic matter below the surface layer, or the pebble content of the substratum is more than 25 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Selfridge and Minoa soils in positions on the landscape similar to those of the Thetford soil. The Selfridge soils have a loamy substratum. The Minoa soils have a stratified loamy subsoil and substratum. These soils are not as droughty during warm seasons as the Thetford soil. Also included are small areas of the very poorly drained Gilford soils and the poorly drained Kingsville soils, which are in depressions and drainageways. Also included are small areas of the well drained Spinks soils on ridgetops and the tops of knolls. The included soils make up 10 to 20 percent of the map unit.

Permeability is moderately rapid in the upper part of the soil and rapid in the lower part. The available water capacity is low. Surface runoff is very slow or slow. The seasonal high water table is at a depth of 1 foot to 2 feet during winter and spring.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, management concerns are removing excess water during wet periods, increasing organic matter content, controlling soil blowing, and conserving soil moisture during dry periods. A combined surface and subsurface drainage system helps control wetness. Shallow surface ditches effectively remove surface water, and subsurface drains help to lower the seasonal high water table. Erosion control structures may be needed where the surface ditches enter other drainageways. To prevent tile lines from becoming filled with fine sand, they should be protected by suitable material. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and supplemental additions of organic matter to the soil help to increase organic matter content of the soil. These practices also help to increase the available water capacity of the soil. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing.

This soil is well suited to use as pasture. If this soil is used as pasture, controlling wetness during winter and spring and conserving soil moisture during dry periods are management concerns. Only those species of pasture plants that tolerate wetness should be planted. During summer months, moisture in this soil is commonly not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, windthrow, equipment limitations, and plant competition are management concerns. The windthrow hazard can be minimized by harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites. Wetness is the main limitation. If buildings with basements are constructed, the building site should be raised, using well compacted fill material. Maintenance of an artificial drainage system and the installation and maintenance of a sump pump may also be needed to

control wetness. Yard use may need to be restricted during wet periods.

This soil has medium potential for use as septic tank absorption fields. Wetness is the main limitation. If a septic tank disposal system is constructed, the absorption field should be placed on suitable fill material. A clay barrier may be needed to raise the site above the seasonal high water table and to prevent the surfacing of effluent.

The land capability classification of this soil is IIIw, and the Michigan soil management group is 4b.

34—Belleville loamy sand. This is a nearly level, poorly drained soil in drainageways, depressions, and broad, low-lying areas. This soil is subject to ponding. Individual areas are irregular in shape and range from 3 to 80 acres or more in size.

Typically, the surface layer is very dark grayish brown loamy sand about 12 inches thick. The subsoil is grayish brown, mottled, loose sand about 21 inches thick. The substratum to a depth of about 60 inches is gray, mottled, calcareous loam. In places, the depth to the substratum is less than 20 inches or more than 40 inches. In places, the surface layer is sandy loam.

Included with this soil in mapping are small areas of the poorly drained Parkhill and Corunna soils in positions on the landscape similar to those of the Belleville soil. The Parkhill and Corunna soils have more clay in the subsoil. If drained, these soils are not so droughty during warm periods of the year as the Belleville soil. Also included are small areas of the somewhat poorly drained Selfridge soils on low knolls and ridges. The included soils make up 5 to 15 percent of the map unit.

Permeability is rapid in the upper part of the profile and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface from autumn to spring. The shrink-swell potential of the substratum is moderate.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, management concerns are removing excess water, locating drainage outlets, increasing the content of organic matter, and controlling soil blowing. Artificial drainage is needed for optimum crop production. A combined surface and subsurface drainage system helps control wetness. If drainage outlets are available, shallow surface ditches effectively remove surface water, and subsurface drainage helps lower the high water table. Erosion control structures may be needed where the surface ditches enter other drainageways. Lift pumps may be needed in some areas. To prevent tile lines from filling with fine sand, they should be protected by suitable material. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and supplemental additions of organic matter to the soil help to increase the content of organic matter in the soil. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices useful in controlling soil blowing.

This soil is well suited to use as pasture. If this soil is used as pasture, wetness is a management concern. Only those species of pasture plants that tolerate wetness should be planted.

This soil is poorly suited to use as woodland. If this soil is used as woodland, windthrow, equipment limitations, seedling mortality, and plant competition are management concerns. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of planting or logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Seedling losses may be high because of wetness. The rate of seedling survival may be improved by special site preparation, such as bedding before planting or applying herbicides. Special harvesting methods and site preparation help control competition from undesirable plants.

This soil has low potential for use as building sites because of ponding and the shrink-swell potential. If buildings with basements are constructed, the building site should be raised, using well compacted fill material. Maintenance of an artificial drainage system and the installation and maintenance of a sump pump commonly are needed to control ponding. Yard use may need to be restricted during wet periods. Backfilling the foundation trench with suitable coarse textured material can prevent the shrinking and swelling of the soil from damaging the foundations of buildings.

This soil has low potential for use as septic tank absorption fields because of moderately slow permeability and ponding. If a septic tank disposal system is constructed, the absorption field site should be placed on suitable fill material and a clay barrier should be provided to raise the site above the high water table and to prevent the surfacing of effluent. Corrective measures on this soil are expensive, and commonly some degree of limitation remains.

The land capability classification of this soil is IIIw, and the Michigan soil management group is 4/2c.

35B—Metea loamy sand, 1 to 6 percent slopes. This is a nearly level and undulating, well drained soil on knolls, ridges, and broad upland areas. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 80 acres or more.

Typically, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsoil is about 19 inches thick. It is dark yellowish brown, very friable loamy sand in the upper part; yellowish brown, very friable loamy sand in the middle part; and dark brown, friable

loam in the lower part. The substratum to a depth of about 60 inches is dark brown loam over yellowish brown, calcareous loam. In places, there is less than 20 inches of sand. In places, the subsoil is underlain by gravelly or very gravelly sand.

Included with these soils in mapping are small areas of well drained Spinks soils in positions on the landcape similar to those of the Metea soil. Spinks soils do not have a loamy substratum and are more droughty than the Metea soil. Also included are small areas of the somewhat poorly drained Selfridge, Thetford, and Minoa soils in shallow depressions and drainageways. The included soils make up 10 to 15 percent of the map unit.

Permeability is rapid in the upper part of the profile and moderate in the lower part. The available water capacity is moderate. Surface runoff is very slow or slow.

Most areas of this soil are used as cropland. A few are used as pasture or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, controlling soil blowing and increasing organic matter content are management concerns. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. The content of organic matter in the soil can be increased by conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and by supplemental additions of organic matter to the soil.

This soil is well suited to use as pasture. If this soil is used as pasture, overgrazing during dry periods increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, seedling mortality is a management concern. Some seedling losses can be expected during dry summer months. The survival rate of seedlings can be increased by using special planting stock and by special site preparation, such as furrowing before planting or applying herbicides.

This soil has high potential for use as building sites and septic tank absorption fields. Moderate permeability is a concern if areas of this soil are used as septic tank absorption fields. Enlarging the absorption field or constructing dual alternating absorption fields may be necessary to overcome the permeability limitation.

The land capability classification of this soil is IIIe, and the Michigan soil management group is 4/2a.

36—Adrian muck. This is a nearly level, very poorly drained soil in bogs, drainageways, and other depressional areas. This soil is subject to ponding. Individual areas are irregular in shape. The areas range in size from 3 to 400 acres or more.

Typically, the surface layer is black muck about 11 inches thick. The underlying tiers to a depth of about 26 inches are also black muck. The substratum extends to a depth of more than 60 inches. It is dark gray and gray, calcareous sand in the upper part; stratified grayish brown, calcareous very fine sand and silt in the middle part; and gray, calcareous gravelly sand in the lower part. In places, the thickness of the organic layers is less than 16 inches or more than 51 inches. In places, there is more than 2 inches of marl or sedimentary peat above the substratum.

Included with this soil in mapping are small areas of the very poorly drained Pinnebog soils and the poorly drained Kingsville soils. Both of these soils are in positions on the landscape similar to those of the Adrian soil. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately slow to moderately rapid in the organic layers and rapid in the sandy substratum. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table at or above the surface during winter and spring.

Most areas of this soil support cattails, water-tolerant grasses and sedges, or tree species that tolerate wetness. A few areas are used as pasture, and a few drained areas are used as cropland.

This soil is generally not suited to use as cropland or pasture. However, if this soil is drained and protected from soil blowing, it is moderately well suited to crops, such as corn, or to speciality crops, such as mint.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, management concerns are windthrow, equipment limitations, seedling mortality, and plant competition. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. This soil is generally not suited to the use of ordinary crawler tractors or rubber-tired skidders because of wetness and low soil stability. Special equipment is needed to harvest wood products. Seedling losses may be high because of wetness. Special site preparation, such as bedding before planting or applying herbicides, can increase the rate of seedling survival. Special harvesting methods and site preparation may also be needed to control competition from undesirable plants.

This soil has very low potential for use as building sites and septic tank absorption fields. Limitations caused by ponding and low soil strength are difficult and expensive to overcome.

The land capability classification of this soil is Vw, and the Michigan soil management group is M/4c.

39A—Londo loam, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges and broad plains. Individual areas of this soil are irregular in shape. The areas range in size from 3 to 2,000 acres or more.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The next part, about 5 inches thick, is mottled, mixed yellowish brown loam and pale brown sandy loam. The subsoil is dark yellowish brown,

mottled, firm clay loam about 8 inches thick. The mottled substratum to a depth of about 60 inches is grayish brown loam overlying brown, calcareous loam. In places, the surface layer is more than 10 inches thick, and in places, it is sandy loam or loamy sand. In some areas, the upper part of the subsoil is not present or has been destroyed by plowing. In places, the depth to the substratum is more than 25 inches, or there is more clay in the subsoil.

Included with this soil in mapping are small areas of the somewhat poorly drained Selfridge soils on low knolls and ridges. The Selfridge soils have more sand in the subsoil than the Londo soil and are droughty during warm periods of the year. Also included are small areas of the poorly drained Parkhill and Corunna soils, which are in depressions and drainageways. Small areas of the well drained Guelph soils, on ridgetops and the tops of knolls, are also included. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderate or moderately slow. The available water capacity is high. Surface runoff is slow. The seasonal high water table is at a depth of 1 foot to 2 feet during winter and spring. The shrink-swell potential of the subsoil and substratum is moderate.

Most areas of this soil are used as cropland. A few areas are used as pasture.

This soil is well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, management concerns are removing excess water during wet periods and maintaining soil tilth. A combined surface and subsurface drainage system helps control wetness. Shallow surface ditches effectively remove surface water, and subsurface drainage helps to lower the high water table. Erosion control structures may be needed where the surface ditches enter other drainageways. Tilling this soil at the proper moisture content prevents clods from forming and the soil from becoming compacted. It also helps to maintain good soil tilth, as do conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the soil and supplemental additions of organic matter to the soil.

This soil is well suited to use as pasture. If this soil is used as pasture, controlling wetness during winter and spring and preventing soil compaction are management concerns. Only those species of pasture plants that tolerate wetness should be planted. Overgrazing or grazing when this soil is too wet can cause soil compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricting use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to use as woodland. If this soil is used as woodland, windthrow, plant competition, and equipment limitations are management concerns. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites and septic tank absorption fields. Wetness and shrink-swell potential are the main management concerns if this soil is used as building sites. If buildings with basements are constructed, the building site should be raised, using well compacted, suitable fill material. Maintenance of an artificial drainage system and the installation and maintenance of a sump pump may also be needed to control the wetness limitation. Yard use may need to be restricted during wet periods.

This soil has medium potential for use as septic tank absorption fields. The main management concerns are wetness and the moderate or moderately slow permeability. If a septic tank disposal system is constructed, the absorption field site should be placed on suitable fill material and a clay barrier should be provided to raise the site above the seasonal high water table and to prevent the surfacing of effluent.

The land capability classification of this soil is IIw, and the Michigan soil management group is 2.5b.

40—Parkhill loam. This is a nearly level, poorly drained soil in drainageways, depressions, and broad, low-lying areas. This soil is subject to ponding. Individual areas are elongated or irregular in shape. The areas range from 3 to 2,000 acres or more in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is grayish brown, mottled, friable loam about 26 inches thick. The substratum to a depth of about 60 inches is grayish brown, mottled, calcareous loam. In places, the surface layer is more than 10 inches thick. The reaction of the surface layer and subsoil is medium acid in places. In places, the depth to the substratum is more than 45 inches or less than 20 inches. In places, there is more clay in the subsoil.

Included with this soil in mapping are small areas of the poorly drained Gilford and Belleville soils in positions on the landscape similar to those of the Parkhill soil. These soils have more sand in the subsoil than the Parkhill soil. If drained, the Gilford and Belleville soils are droughty during warm periods of the year. Also included are small areas of the somewhat poorly drained Londo and Selfridge soils on low knolls and ridges. The included soils make up 0 to 15 percent of the map unit.

Permeability is moderately slow in the upper part of the profile and moderate in the lower part. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface during winter and spring.

Most areas of this soil are used as cropland. A few areas are used as woodland and pasture.

This soil is well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, removing excess water and maintaining soil tilth are management concerns. Artificial drainage is needed for optimum crop production. A combined surface and subsurface drainage system helps control wetness. Shallow surface ditches effectively remove surface water. Erosion control structures may be needed where the surface ditches enter other drainageways. If drainage outlets are available, subsurface drainage helps to lower the high water table. Lift pumps may be needed in some areas. Tilling this soil at the proper moisture content prevents clods from forming and the soil from becoming compacted. It also helps to maintain good soil tilth, as do conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the soil and supplemental additions of organic matter to the soil.

This soil is well suited to use as pasture. If this soil is used as pasture, wetness and soil compaction are management concerns. Only those species of pasture plants that tolerate wetness should be planted. Overgrazing or grazing when this soil is too wet can cause surface compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to use as woodland. If this soil is used as woodland, management concerns are windthrow, equipment limitations, seedling mortality, and plant competition. The windthrow hazard can be minimized by use of harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of planting or logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Seedling losses may be high because of wetness. Special site preparation, such as bedding before planting or applying herbicides, may increase the survival rate of seedlings. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has low potential for use as building sites. Ponding is the main management concern. If buildings with basements are constructed, the site should be raised, using well compacted fill material. Maintenance of an artificial drainage system and the installation and maintenance of a sump pump commonly are needed to control wetness. Yard use may need to be restricted during wet periods.

This soil has low potential for use as septic tank absorption fields because of ponding and the moderately slow permeability of the soil. If a septic tank disposal system is constructed, the absorption field site may have to be placed on suitable fill material and a clay barrier may be needed to raise the site above the high water table and prevent the surfacing of effluent. Corrective measures on this soil are expensive, and commonly some degree of limitation remains.

The land capability classification of this soil is IIw, and the Michigan soil management group is 2.5c.

42—Edwards muck. This is a nearly level, very poorly drained soil in bogs, drainageways, and other depressional areas. This soil is subject to ponding. Individual areas of this soil are irregular in shape and range from 3 to 300 acres or more in size.

Typically, the surface layer is black muck about 9 inches thick. The underlying tiers, to a depth of about 24 inches, are black and very dark grayish brown muck. The substratum to a depth of about 60 inches is light brownish gray, mottled marl. In places, the thickness of the organic layers is less than 16 inches or more than 51 inches. In places, there is more than 2 inches of sedimentary peat above the marl. In some areas, there is a loamy or sandy substratum between 30 and 60 inches below the surface.

Permeability is moderately slow to moderately rapid. The available water capacity is high. Surface runoff is very slow or ponded. This soil has a high water table near or above the surface from autumn to early summer.

Most areas of this soil support cattails, water-tolerant grasses and sedges, or trees that tolerate wetness. A few areas are used as pasture, and a few drained areas are used as cropland.

This soil is not suited to use as cropland and pasture. However, if areas can be drained and protected from soil blowing, this soil is moderately well suited to such crops as corn or to specialty crops, such as mint.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, windthrow, equipment limitations, seedling mortality, and plant competition are management concerns. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. This soil is generally not suited to the use of ordinary crawler tractors or rubber-tired skidders because of wetness and the low stability of the soil. Special equipment is needed to harvest wood products. Seedling losses may be high because of wetness. The rate of seedling survival can be improved by special site preparation, such as bedding before planting or applying herbicides. Special harvesting methods and site preparation may also be needed to control competition from undesirable plants.

This soil has very low potential for use as building sites and septic tank absorption fields. Limitations caused by the ponding hazard and low soil strength are difficult to overcome.

The land capability classification of this soil is Vw, and the Michigan soil management group is M/mc.

45B—Guelph-Londo loams, 1 to 6 percent slopes. This map unit consists of intermingled well drained Guelph soil and somewhat poorly drained Londo soil on undulating uplands. The Guelph soil is on knolls and ridges, and the Londo soil is on low knolls and ridges and in slight depressions. The areas of these soils are so small or so intricately mixed that it was not practical to map them separately. The mapped areas are 40 to 60 percent Guelph soil and 20 to 50 percent Londo soil. The areas are irregular in shape and range from 20 to 400 acres or more in size.

Typically, the Guelph soil has a surface layer of very dark grayish brown loam about 9 inches thick. The next layer, about 4 inches thick, is friable, mixed dark yellowish brown clay loam and brown sandy loam. The subsoil, about 12 inches thick, is dark yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous loam. In places, the depth to the substratum is more than 25 inches. In some areas, there is no mixed layer beneath the surface layer, or it has been destroyed by plowing. In places, the surface layer is loamy sand.

Typically, the Londo soil has a surface layer of very dark grayish brown loam about 9 inches thick. The next layer, about 5 inches thick, is friable, mixed yellowish brown, mottled loam and light yellowish brown, mottled sandy loam. The subsoil, about 8 inches thick, is dark yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is grayish brown, mottled, calcareous loam. In places, the surface layer is more than 10 inches thick, and in places, it is sandy loam or loamy sand. In some areas, there is no mixed layer below the surface layer, or it has been destroyed by plowing. In places, the depth to the substratum is more than 25 inches.

Included with the Guelph and Londo soils in mapping are small areas of the somewhat poorly drained Selfridge soils on low knolls. The Selfridge soils have more sand in the subsoil than the Londo soil and are more droughty. Also included are small areas of Guelph soils that have a seasonal high water table at a depth of 3 to 6 feet during winter and spring. Also included are small areas of the poorly drained Parkhill and Corunna soils, which are in depressions and drainageways. The included soils make up 5 to 20 percent of the map unit.

Permeability of the Guelph soil is moderate. Permeability of the Londo soil is moderate or moderately slow. The available water capacity of both soils is high. Surface runoff is medium on the Guelph soil and slow on the Londo soil. The Londo soil has a seasonal high water table at a depth of 1 foot to 2 feet during winter and spring. The Londo soil has a moderate shrink-swell potential in the subsoil and substratum.

Most areas of these soils are used as cropland. A few are used as woodland or for hay and pasture.

The soils are well suited to such crops as corn, small grains, beans, and grass-legume hay. If the soils are used as cropland, controlling water erosion, removing excess water during the wet periods, and improving soil tilth are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to control water erosion by reducing surface crusting and increasing the rate of water infiltration. The use of a cropping system that includes close-growing crops also helps to control erosion. Grassed waterways, diversions, and drop structures help reduce gullying. A combined surface and subsurface drainage system helps reduce wetness. Shallow surface ditches effectively remove surface water. Erosion control structures may be needed where the surface ditches enter other drainageways. Subsurface drainage helps to lower the high water table. Tilling the soils at the proper moisture content prevents soil compaction and the formation of clods and helps to maintain good tilth. Conservation tillage and supplemental additions of organic matter to the soil also help maintain good tilth.

These soils are well suited to use as pasture. If they are used as pasture, water erosion and wetness in winter and spring are management concerns in some areas. Soil compaction is an additional management concern. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion. Overgrazing or grazing when the soils are too wet can cause soil compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

These soils are well suited to use as woodland. If they are used as woodland, plant competition is a management concern. Windthrow and equipment limitations are management concerns in some areas. Special harvesting methods and site preparation may be needed to control competition from undesirable plants. To minimize the windthrow hazard, harvesting methods can be used that do not leave the remaining trees standing alone or widely spaced. The use of planting or logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen.

The Guelph soil has high potential for use as building sites, and the Londo soil has medium potential. Wetness and shrink-swell potential are the major limitations to use of the Londo soil as building sites. If buildings with basements are constructed, the building site should be raised, using well compacted suitable fill material. Maintenance of an artificial drainage system and the installation and maintenance of a sump pump may also be needed to control wetness. Yard use may need to be restricted during wet periods.

The Guelph soil has high potential for use as septic tank absorption fields, and the Londo soil has medium potential. Wetness and the permeability are the main limitations on the Londo soil. If a septic tank disposal

system is constructed on the Londo soil, the absorption field should be placed on suitable fill material and a clay barrier provided to raise the field above the seasonal high water table and to prevent the surfacing of effluent.

The land capability classification of these soils is IIe, and the Michigan soil management group is 2.5a and 2.5b.

47—Algansee loamy sand. This is a nearly level, somewhat poorly drained soil on flood plains. This soil is occasionally flooded by stream overflow for brief periods. Individual areas of this soil are irregular in shape and are commonly bordered by escarpments on the upland side. The areas range in size from 5 to 100 acres or more.

Typically, the surface layer is very dark gray loamy sand about 8 inches thick. The substratum to a depth of about 60 inches is multicolored sand. In places, there is more silt and clay in the substratum.

Included with this soil in mapping are small areas of the poorly drained Cohoctah soils that are slightly lower on the landscape than the Algansee soil. They make up 0 to 15 percent of the map unit.

Permeability is rapid. The available water capacity is low. Surface runoff is very slow or slow. The seasonal high water table is at a depth of 1 foot to 2 feet during winter and spring.

Most areas of this soil are used as woodland. A few areas are used as pasture or cropland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, management concerns are controlling flooding, removing excess water during wet periods, controlling soil blowing, conserving soil moisture during dry periods, and increasing the content of organic matter. Providing for surface drainage, so that late crops can be planted after floodwaters recede, helps reduce the limitations caused by flooding. Subsurface drainage systems also help control wetness. Erosion control structures may be needed where the surface ditches enter other drainageways. Practices used to control soil blowing are conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface, cover crops, buffer strips, and field windbreaks. The content of organic matter in the soil can be increased by conservation tillage and supplemental additions of organic matter to the soil. These practices also help to increase the available water capacity of the soil.

This soil is well suited to use as pasture. If this soil is used as pasture, flooding, wetness during winter and spring, and the need to conserve soil moisture during dry periods are management concerns. Surface drainage and restricted use during the flood season help minimize the flood hazard. Only those species of pasture plants that tolerate wetness should be planted. During the summer months, the moisture content of this soil commonly is not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, management concerns are windthrow, equipment limitation, and plant competition. The windthrow hazard can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Special harvesting methods and site preparation help control competition from undesirable plants.

This soil has low potential for use as building sites and very low potential for septic tank absorption fields. Flooding and wetness are the main concerns in management. Overcoming these limitations is difficult and very costly.

The land capability classification of this soil is IIIw, and the Michigan soil management group is L-4c.

49B—Marlette loam, 2 to 6 percent slopes. This is an undulating, well drained soil on knolls, ridges, and broad upland areas. Individual areas are irregular in shape and range from 3 to 770 acres or more in size.

Typically, the surface layer is dark brown loam about 9 inches thick. The next part, about 9 inches thick, is firm, mixed dark brown clay loam and pale brown sandy loam. The subsoil, about 22 inches thick, is dark brown friable clay loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous clay loam. In places, the upper part of the subsoil is not present, or it has been destroyed by plowing. In places, the depth to the substratum is less than 25 inches or greater than 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Londo soil and the poorly drained Parkhill soil. The Londo soils are on low knolls and side slopes, and the Parkhill soils are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately slow. Available water capacity is high. Surface runoff is medium.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, controlling water erosion and maintaining good soil tilth are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps control water erosion by reducing surface crusting and increasing the rate of water infiltration. Including close-growing crops in the cropping system also helps control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Tilling this soil at the proper moisture content prevents clods from forming and

the soil from becoming compacted. It also helps to maintain good soil tilth, as do conservation tillage and supplemental additions of organic matter to the soil.

This soil is well suited to use as pasture. If this soil is used as pasture, preventing soil compaction is a management concern. Overgrazing or grazing this soil when it is too wet can cause soil compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to use as woodland. If this soil is used as woodland, plant competition is a management concern. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites and medium potential for use as septic tank absorption fields. Moderately slow permeability is the main concern in areas used as septic tank absorption fields. Dual alternating absorption fields may be needed to overcome the permeability limitation.

The land capability classification of this soil is IIe, and the Michigan soil management group is 2.5a.

49C—Marlette loam, 6 to 12 percent slopes. This is a gently rolling, well drained soil on knolls, ridges, and broad upland areas. Individual areas are irregular in shape and range from 3 to 300 acres or more in size.

Typically, the surface layer is dark brown loam about 8 inches thick. The next part, about 9 inches thick, is firm, mixed dark brown clay loam and pale brown sandy loam. The subsoil, about 22 inches thick, is dark brown, friable clay loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous clay loam. In some areas, the upper part of the subsoil is not present or has been destroyed by plowing. In places, the depth to the substratum is less than 25 inches or greater than 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Londo soils and the poorly drained Parkhill soils. The Londo soils are on low knolls and side slopes, and the Parkhill soils are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately slow. Available water capacity is high. Surface runoff is medium.

Most areas of this soil are used as pasture. A few areas are used as cropland or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, controlling water erosion and maintaining good soil tilth are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to control water erosion by reducing surface crusting and increasing the rate of water infiltration. Including close-growing crops in the cropping system also helps control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Tilling this soil at the proper moisture content prevents clods from forming and the soil from becoming compacted. It also helps to maintain good soil tilth, as do conservation tillage and supplemental additions of organic matter to the soil.

This soil is well suited to use as pasture. If this soil is used as pasture, preventing water erosion and soil compaction are management concerns. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion. Overgrazing or grazing when this soil is too wet can cause soil compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to use as woodland. If this soil is used as woodland, plant competition is a management concern. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites. Slope is the main management concern. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be necessary in some areas. Slopes should be stabilized to prevent erosion.

This soil has medium potential for use as septic tank absorption fields. Slope and the moderate permeability of the soil are the main limitations. Dual absorption fields placed on the contour may be needed to overcome the permeability and slope limitation.

The land capability classification of this soil is IIIe, and the Michigan soil management group is 2.5a.

49D—Marlette loam, 12 to 20 percent slopes. This is a rolling, well drained soil on high knolls and ridges. Individual areas of this soil are irregular in shape and range in size from 3 to 20 acres or more.

Typically, the surface layer is dark brown loam about 7 inches thick. The next part, about 9 inches thick, is firm, mixed dark brown clay loam and pale brown sandy loam. The subsoil, about 22 inches thick, is dark brown, friable clay loam. The substratum to a depth of about 60 inches is yellowish brown, calcareous clay loam. In some areas, the upper part of the subsoil is not present or has been destroyed by plowing. In places, the depth to the substratum is less than 25 inches or greater than 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Londo soils and the poorly drained Parkhill soils. The Londo soils are on low knolls and side slopes, and the Parkhill soils are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately slow. Available water capacity is high. Surface runoff is rapid.

Most areas of this soil are used as pasture or are in woodland. A few areas are used as cropland.

This soil is poorly suited to use as cropland, but such crops as corn, small grains, and grass-legume hays can be grown. If this soil is used as cropland, water erosion, soil tilth, and equipment limitations associated with slope are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to reduce water erosion by reducing surface crusting and increasing the rate of water infiltration. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures can be used to prevent gullying. Performing tillage operations at the proper soil moisture content prevents clods from forming and the soil from becoming compacted. It also helps to maintain good soil tilth, as do conservation tillage and supplemental additions of organic matter to the soil. Farming on the contour minimizes equipment limitations associated with slope and helps to control erosion.

This soil is moderately well suited to use as pasture. If this soil is used as pasture and hay crops, water erosion, soil compaction, and equipment limitations associated with slope are management concerns. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion. Overgrazing or grazing this soil when it is too wet can cause soil compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to use as woodland. If this soil is used as woodland, plant competition is a management concern. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites. Slope is the main concern if areas of this soil are used for buildings. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be necessary in some areas. Slopes should be stabilized to prevent erosion.

This soil has low potential for use as septic tank absorption fields because of slope and the moderately slow permeability of the soil. Dual absorption fields placed on the contour may be needed to overcome the permeability and slope limitations. Slopes should be stabilized to prevent the surfacing of effluent.

The land capability classification of this soil is IVe, and the Michigan soil management group is 2.5a.

50A—Mecosta sand, 0 to 3 percent slopes. This is a nearly level, somewhat excessively drained soil on broad upland plains and low knolls. Individual areas of this soil are irregular in shape and range in size from 3 to 480 acres or more.

Typically, the surface layer is very dark grayish brown sand about 9 inches thick. The subsoil is about 30 inches thick. It is strong brown, loose sand in the upper part; dark brown, very friable, gravelly loamy sand in the middle part; and dark yellowish brown, loose, gravelly sand overlying yellowish brown, loose very gravelly sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown, calcareous, extremely gravelly sand. In places, the depth to the substratum is more than 40 inches. In places, the pebble content of the lower part of the subsoil and of the substratum is less than 25 percent. In places, there is no clay accumulation in the subsoil.

Included with this soil in mapping are small areas of the well drained Ormas soils that are slightly lower on the landscape than the Mecosta soil. The included soils make up 0 to 10 percent of the map unit.

Permeability is rapid in the upper part of the soil and very rapid in the lower part. The available water capacity is very low. Surface runoff is very slow.

Most areas of this soil are used as pasture. A few areas are used as woodland and cropland.

This soil is poorly suited to use as cropland, but such crops as small grains and grass-legume hays can be grown. If this soil is used as cropland, increasing organic matter content, conserving soil moisture during dry periods, and controlling soil blowing are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and supplemental additions of organic matter to the soil help to maintain or increase the content of organic matter in the soil. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. These practices also help to increase the available water capacity of the soil. If water of sufficient quantity and quality is available, irrigation helps to overcome the limitation of low available water.

This soil is well suited to use as pasture. If this soil is used as pasture, conserving soil moisture during dry periods is a management concern. During the summer months, moisture in this soil is commonly not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, seedling mortality and plant competition are management concerns. Some seedling losses can be expected during dry summer months. The survival rate of seedlings can be improved by the use of special planting stock and by special site preparations, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites and septic tank absorption fields. The poor filtering capacity of the soil is the major limitation to the use of this soil for septic tank absorption fields. This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in the pollution of groundwater supplies. Seepage should be monitored by periodically testing wells for contamination.

The land capability classification of this soil is IVs, and the Michigan soil management group is Ga.

51—Pits, gravel. This map unit consists of open excavations from which sand and gravel have been removed for use elsewhere as fill or aggregate. The material that remains supports few plants. The pit bottoms may be dry, seasonally flooded, or flooded year-round where the excavation is below the water table. Individual areas vary considerably in shape and range from 3 to 120 acres in size.

Most areas are used as wildlife habitat or are still being mined. A few areas are used for recreation. Onsite investigation is necessary to determine the suitability for specific uses.

These areas were not assigned to interpretative groups.

52—Udorthents, loamy. This map unit consists of nearly level and undulating, well drained to somewhat poorly drained soils that have been disturbed. In some places, the original surface layer and part of the substratum have been removed, exposing loamy material. In other places, the original soil has been covered by loamy fill material. The individual areas vary considerably in shape, and many are bordered by escarpments. The areas range in size from 3 to 100 acres. Texture and color are quite variable.

Included with these soils in mapping are small areas of poorly drained soils. They make up 0 to 10 percent of the mapped areas.

Most areas are idle or are used as sites for buildings. Onsite investigation is necessary to determine the suitability for specific uses.

These soils were not assigned to interpretative groups.

53—Udipsamments, nearly level. This map unit consists of nearly level, excessively drained to somewhat poorly drained soils that have been disturbed. In some areas, the original surface layer and part of the substratum have been removed, exposing sandy material. In other areas, the original soil has been covered by sandy fill material. The individual areas of this soil vary considerably in shape, and many are bordered by escarpments. The areas range in size from 3 to 70 acres. Texture and color are quite variable.

Included with these soils in mapping are small areas of poorly drained soils. They make up 0 to 10 percent of the mapped areas.

Most areas are idle or are used as sites for buildings. Onsite investigation is necessary to determine the suitability for specific uses.

These soils were not assigned to interpretative groups.

54—Histosols and Aquents, ponded. This map unit consists of nearly level, very poorly drained organic soils and very poorly drained sandy or loamy mineral soils. These soils are generally in marsh areas, most of which are always ponded. Individual areas are irregular in shape and range from 3 to 40 acres in size. Many areas are predominantly Histosols, and others are Aquents. Both soils are present in some areas. These soils are so similar in use and management that it was not practical to map them separately.

Included with these soils in mapping are small areas of open water that make up 5 to 10 percent of the mapped areas.

Most areas of these soils support marsh vegetation or wetland tree species. They are not suited to use as cropland, pasture, or woodland. They are well suited to wetland wildlife habitat.

The soils have very low potential for use as septic tank absorption fields and building sites. The limitations caused by ponding, high water table, and soil strength are difficult and very costly to overcome.

The land capability classification of these soils is VIIIw.

55A—Urban land-Mecosta complex, 0 to 3 percent slopes. This map unit consists of Urban land and the nearly level, somewhat excessively drained Mecosta soil on low knolls and broad upland plains. The areas Urban land and Mecosta soil are so small or so intricately mixed that it was not practical to map them separately. The mapped areas are about 50 to 80 percent Urban land and 10 to 35 percent Mecosta soil. The areas are irregular in shape and range from 40 to 400 acres or more in size.

The Urban land is covered by streets, parking lots, buildings, and other structures that obscure or alter the soil so that it cannot be identified.

Typically, the Mecosta soil has a surface layer of very dark grayish brown sand about 9 inches thick. The subsoil is about 30 inches thick. It is strong brown, loose sand in the upper part; dark brown, very friable gravelly loamy sand in the middle part; and dark yellowish brown and yellowish brown, loose gravelly sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown, calcareous, very gravelly sand. In places, the depth to the substratum is more than 40 inches. In places, the pebble content of the lower part of the subsoil and the substratum is less than 25 percent. In places, there is no clay accumulation in the subsoil.

In some places, the natural surface layer of the Mecosta soils has been covered by soil material excavated for basements. The fill material is generally less than 18 inches thick over the original soil. Some high spots have been cut and smoothed.

Included with this soil in mapping are small areas of the moderately well drained Covert soils and the somewhat poorly drained Wasepi and Thetford soils. They are slightly lower on the landscape than the Mecosta soil. The included soils make up 5 to 20 percent of the map unit.

The permeability of the Mecosta soil is rapid in the upper part of the soil and very rapid in the lower part. The available water capacity is very low. Surface runoff is very slow. Most areas of this map unit are artificially drained through sewer systems and gutters.

The Mecosta soil, or open part of the map unit, is used for building sites, lawns, gardens, parks, and open space.

The Mecosta soil is poorly suited to lawns and gardens because of the very low available water capacity of the soil. Frequent watering during dry periods helps overcome this limitation.

The Mecosta soil has high potential for use as building sites. All sanitary facilities should be connected to a municipal sewerage system.

This map unit was not assigned to interpretative groups.

56A—Urban land-Thetford complex, 0 to 3 percent slopes. This map unit consists of Urban land and the nearly level, somewhat poorly drained Thetford soil on knolls and broad upland plains. The areas of Urban land and Thetford soil are so small or so intricately mixed that it was not practical to map them separately. The mapped areas are about 50 to 80 percent Urban land and 10 to 40 percent Thetford soil. The areas are irregular in shape and range from about 40 to 600 acres or more in size.

The Urban land is covered by streets, parking lots, buildings, and other structures that obscure or alter the soil so that it cannot be identified.

Typically, the Thetford soil has a surface layer of dark brown loamy sand about 10 inches thick. The subsurface layer is yellowish brown, mottled, loose sand about 17 inches thick. The next part is light yellowish brown, loose sand. It has 1/4- to 3-inch thick textural bands of dark yellowish brown, mottled, very friable loamy sand about 11 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled sand. In places, the textural bands are not present or the total accumulation of material in the bands is less than 6 inches. In places, iron, aluminum, and organic matter have accumulated below the surface layer, or the pebble content of the substratum is more than 25 percent.

In some places, the natural surface layer of the Thetford soil has been covered by soil material excavated for basements. The fill material is generally less than 18 inches thick over the original soil.

The permeability of the Thetford soil is moderately rapid in the upper part of the soil and rapid in the lower part. The available water capacity is low. Surface runoff is very slow. Most areas of this unit are artificially drained through sewer systems, gutters, and drainage tile.

The Thetford soil, or open part of the map unit, is used for building sites, lawns, gardens, or open space.

The Thetford soil is moderately well suited to lawns and gardens, if drainage is provided. Onsite investigation is needed to determine the best method of artificial drainage for a particular location. Lawns and gardens need to be watered frequently during dry periods to overcome the limitation of low available water capacity.

The Thetford soil has medium potential for use as building sites. Wetness is the major concern in areas of this soil that are used for buildings. If buildings are constructed, the building site should be raised, using well compacted, suitable fill material. Installation and maintenance of a sump pump may also be needed to control wetness. All sanitary facilities should be connected to municipal sewerage service.

Onsite investigation is essential to proper evaluation and planning of development for specific areas.

This map unit was not assigned to interpretative groups.

57A—Urban land-Londo complex, 0 to 3 percent slopes. This map unit consists of Urban land and the nearly level, somewhat poorly drained Londo soil on knolls and broad upland plains. The areas of Urban land and Londo soil are so small or so intricately mixed that it was not practical to map them separately. The mapped areas are 50 to 80 percent Urban land and 10 to 35 percent Londo soil. The areas are irregular in shape and range from 80 to 600 acres or more in size.

The Urban land is covered by streets, parking lots, buildings, and other structures that obscure or alter the soil so that it cannot be identified.

Typically, the Londo soil has a surface layer of very dark grayish brown loam about 9 inches thick. The next part, about 5 inches thick, is friable, mixed, yellowish brown, mottled loam and light yellowish brown, mottled sandy loam. The subsoil, about 8 inches thick, is dark yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is grayish brown and brown, mottled, calcareous loam. In places, the surface layer is sandy loam or loamy sand. In some areas, the mixed layer beneath the surface layer is not present or the depth to the substratum is more than 25 inches.

In some places, the natural surface layer of the Londo soil has been covered by soil material excavated for basements. The fill material is generally less than 18 inches thick over the original soil.

Included with this soil in mapping are small areas of well drained Guelph soils on ridgetops and the tops of

knolls and poorly drained Parkhill soils, which are in depressions and drainageways. The included soils make up 10 to 20 percent of the map unit.

Permeability of the Londo soil is moderate or moderately slow. The available water capacity is high. Surface runoff is slow. Most areas of this map unit are artificially drained through sewer systems, gutters, and drainage tile. Shrink-swell potential is moderate in the subsoil and substratum.

The Londo soil, or open part of the map unit, is used for building sites, lawns, gardens, or open space.

The Londo soil is well suited to lawns and gardens, if drainage is provided. Onsite investigation is needed to determine the best method of artificial drainage for a particular location.

The Londo soil has medium potential for use as building sites. Wetness and shrink-swell potential are the major concerns in areas of this soil used for buildings. If buildings with basements are constructed, the building site should be raised, using well compacted, suitable fill material. Installation and maintenance of a sump pump may also be needed. Yard use may need to be restricted during wet periods. All sanitary facilities should be connected to municipal sewerage service.

Onsite investigation is essential to proper evaluation and planning of development for specific areas.

This map unit was not assigned to interpretative groups.

60B—Guelph loam, 2 to 6 percent slopes. This is an undulating, well drained soil on knolls, ridges, and broad upland areas. Individual areas are irregular in shape and range from 3 to 400 acres or more in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The next part, about 4 inches thick, is friable, mixed dark yellowish brown clay loam and brown sandy loam. The subsoil, about 12 inches thick, is dark yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous loam. In places, the depth to the substratum is more than 25 inches. In some areas, the mixed upper part of the subsoil is not present or has been destroyed by plowing. In places, the surface layer is loamy sand, or there is more clay in the subsoil.

Included with this soil in mapping are small areas of the well drained Metea and Arkport soils and areas of the moderately well drained Guelph soils. These included soils are in positions on the landscape similar to those of the well drained Guelph soil. The Metea soils have a sandy subsoil, and the Arkport soils have more sand than the Guelph soil. These soils are more droughty than the Guelph soil. Also included are small areas of the somewhat poorly drained Londo and Selfridge soils on low knolls and side slopes and areas of the poorly drained Parkhill soils, which are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderate. The available water capacity is high. Surface runoff is medium.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, controlling water erosion and maintaining good soil tilth are management concerns. Practices used to control water erosion include conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and the use of close-growing crops in the cropping system. Grassed waterways, diversions, and drop structures help prevent gullying. Performing tillage operations at the proper soil moisture content prevents clods from forming and the soil from becoming compacted. It also helps to maintain good tilth, as do conservation tillage and supplemental additions of organic matter to the soil.

This soil is well suited to use as pasture. If this soil is used as pasture, soil compaction is a management concern. Overgrazing or grazing when this soil is too wet can cause soil compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to use as woodland. If this soil is used as woodland, plant competition is a management concern. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites and septic tank absorption fields. There are no major management concerns.

The land capability classification of this soil is IIe, and the Michigan soil management group is 2.5a.

60C—Guelph loam, 6 to 12 percent slopes. This is a gently rolling, well drained soil on knolls, ridges, and broad upland areas. Individual areas are irregular in shape and range from 3 to 470 acres or more in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The next part, about 4 inches thick, is friable, mixed dark yellowish brown clay loam and brown sandy loam. The subsoil, about 12 inches thick, is dark yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous loam. In places, the depth to the substratum is more than 25 inches. In some areas, the mixed upper part of the subsoil is not present or has been destroyed by plowing. In places, the surface layer is loamy sand, or there is more clay in the subsoil.

Included with this soil in mapping are small areas of the well drained Metea and Arkport soils and areas of the moderately well drained Guelph soils in positions on the landscape similar to those of the well drained Guelph soil. The Metea soils have a sandy subsoil. The Arkport soils contain more sand than the Guelph soil. These

soils are more droughty. Also included are small areas of the somewhat poorly drained Londo and Selfridge soils on low knolls and on side slopes and areas of the poorly drained Parkhill soils, which are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderate. The available water capacity is high. Surface runoff is medium.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, controlling water erosion and maintaining good soil tilth are management concerns. Practices used to control water erosion include conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and the use of close-growing crops in the cropping system. Grassed waterways, diversions, and drop structures help prevent gullying. Performing tillage operations at the proper soil moisture content prevents clods from forming and the soil from becoming compacted. It also helps to maintain good tilth, as do conservation tillage and supplemental additions of organic matter to the soil.

This soil is well suited to use as pasture. If this soil is used as pasture, controlling water erosion and soil compaction are management concerns. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion. Overgrazing or grazing this soil when it is too wet can cause soil compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to use as woodland. If this soil is used as woodland, plant competition is a management concern. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites and septic tank absorption fields. Slope is the major concern of management. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be necessary in some areas. Slopes should be stabilized to prevent erosion. Septic tank absorption fields should be placed on the contour.

The land capability classification of this soil is IIIe, and the Michigan soil management group is 2.5a.

61A—Selfridge sand, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges and broad plains. Individual areas are irregular in shape and range from 3 to 400 acres or more in size.

Typically, the surface layer is dark brown sand about 9 inches thick. The subsurface layer is yellowish brown sand about 21 inches thick. The subsoil is about 8 inches thick. It is dark yellowish brown, mottled, very friable sandy loam in the upper part and dark brown, mottled, friable clay loam in the lower part. The substratum to a depth of about 60 inches is brown, mottled, calcareous clay loam. In places, there is no clay accumulation in the subsoil. In places, the depth to the substratum is less than 24 inches or greater than 40 inches. In some areas, the surface layer is more than 10 inches thick, or it is sandy loam. In some areas, iron, aluminum, and organic matter have accumulated in the subsoil. Some places have a 1- to 6-inch thick layer of very fine sand and silt above the substratum.

Included with this soil in mapping are small areas of the somewhat poorly drained Londo and Metamora soils in positions on the landscape similar to those of the Selfridge soil. The Londo and Metamora soils have more clay in the subsoil than the Selfridge soil and are droughty in warm periods of the year. Also included are small areas of the poorly drained Parkhill, Belleville, and Corunna soils, which are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is rapid in the upper part of the soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is very slow or slow. The seasonal high water table is at a depth of 1 foot to 2 feet during winter and spring. The shrink-swell potential is moderate in the lower part of the subsoil and the substratum.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, removing excess water during wet periods, increasing organic matter content, and controlling soil blowing are management concerns. A combined surface and subsurface drainage system helps to control wetness. Shallow surface ditches effectively remove surface water. Erosion control structures may be needed where the surface ditches enter other drainageways. If drainage outlets are available, subsurface drainage helps to lower the seasonal high water table. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and supplemental additions of organic matter to the soil help to increase the content of organic matter in the soil. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing.

This soil is well suited to use as pasture. If this soil is used as pasture, wetness during winter and spring is a management concern. Only those species of pasture plants that tolerate wetness should be planted.

This soil is well suited to use as woodland. If this soil is used as woodland, windthrow, equipment limitations, and plant competition are management concerns. The windthrow hazard can be minimized by using harvesting

methods that do not leave the remaining trees standing alone or widely spaced. The use of logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites. Wetness and shrink-swell potential are the major management concerns in areas of this soil used for buildings. If buildings with basements are constructed, the site should be raised, using well compacted suitable fill material. Maintenance of an artificial drainage system and the installation and maintenance of a sump pump may also be needed to overcome the wetness limitation. Yard use may need to be restricted during wet periods.

This soil has medium potential for use as septic tank absorption fields. Wetness and the moderately slow permeability of the soil are the main limitations. If a septic tank disposal system is constructed, the absorption field may have to be placed on suitable fill material and a clay barrier provided to raise the field above the seasonal water table and prevent the surfacing of the effluent.

The land capability classification of this soil is IIIw, and the Michigan soil management group is 4/2b.

62B—Ormas sand, 0 to 6 percent slopes. This is a nearly level and undulating, well drained soil on knolls, ridges, and broad upland areas. Individual areas of this unit are irregular in shape and range from 3 to 240 acres or more in size.

Typically, the surface layer is dark brown sand about 8 inches thick. The subsurface is yellowish brown sand about 14 inches thick. The subsoil is dark brown, friable sandy clay loam and sandy loam about 11 inches thick. The substratum to a depth of about 60 inches is yellowish brown, very gravelly sand. In places, the depth to the substratum is more than 45 inches. In places, the thickness of the subsoil is less than 8 inches or the sandy surface and subsurface layers are less than 20 inches thick.

Included with this soil in mapping are small areas of the excessively drained Plainfield soils and the somewhat excessively drained Mecosta soils in positions on the landscape similar to those of the Ormas soil. Also included are small areas of the somewhat poorly drained Wasepi soils on low knolls and side slopes and the very poorly drained Gilford soils, which are in depressions and drainageways. The included soils make up about 5 to 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the soil and very rapid in the lower part. The available water capacity is low. Surface runoff is slow or very slow.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, increasing the content of organic matter, conserving soil moisture during dry periods, and controlling soil blowing are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and supplemental additions of organic matter to the soil help to increase organic matter content of the soil. Conservation tillage and cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. These practices also help to increase the available water capacity of the soil, as does irrigation if water of sufficient quantity and quality is available.

This soil is well suited to use as pasture. If this soil is used as pasture, conserving soil moisture during dry periods is a management concern. During the summer months the moisture content of this soil is commonly not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, seedling mortality and plant competition are management concerns. Some seedling losses can be expected during dry summer months. The rate of seedling survival can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites and septic tank absorption fields. Poor filtering capacity of the soil is the major concern for septic tank absorption fields. This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in the pollution of groundwater supplies. Seepage should be monitored by periodically testing wells for contamination.

The land capability classification of this soil is IIIs, and the Michigan soil management group is 4a.

62C—Ormas sand, 6 to 12 percent slopes. This is a gently rolling, well drained soil on knolls, ridges, and broad upland areas. Individual areas of this soil are irregular in shape and range from 3 to 60 acres or more in size.

Typically, the surface layer is dark brown sand about 7 inches thick. The subsurface is yellowish brown sand about 14 inches thick. The subsoil is dark brown, friable sandy clay loam and sandy loam about 11 inches thick. The substratum to a depth of about 60 inches is yellowish brown, very gravelly sand. In places, the depth to the substratum is more than 45 inches. In places, the

subsoil is less than 8 inches thick, or the sandy surface and subsurface layers are less than 20 inches thick.

Included with this soil in mapping are small areas of the excessively drained Plainfield soils and the somewhat excessively drained Mecosta soils. These soils are in positions on the landscape similar to those of the Ormas soil. Also included are small areas of the somewhat poorly drained Wasepi soils on low knolls and side slopes and the very poorly drained Gilford soils, which are in depressions and drainageways. The included soils make up about 5 to 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. The available water capacity is low. Surface runoff is slow.

Most areas of this soil are used as pasture or woodland. A few areas are used as cropland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, increasing the organic matter content, conserving soil moisture during dry periods, and controlling soil blowing and water erosion are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and supplemental additions of organic matter to the soil help to increase the content of organic matter in the soil. These practices also help to increase the available water capacity of the soil. Conservation tillage helps to overcome water erosion by reducing surface crusting, thus increasing the rate of water infiltration into the soil. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing

This soil is well suited to use as pasture. If this soil is used as pasture, controlling water erosion and conserving soil moisture during dry periods are management concerns. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion. During the summer months, moisture in this soil is commonly not sufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, preventing seedling mortality and plant competition are management concerns. Some seedling losses can be expected during dry summer months. The rate of seedling survival can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites. Slope is the major concern in areas of this soil used for buildings. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be needed in some areas.

This soil has high potential for use as septic tank absorption fields. Slope and poor filtering capacity of the soil are the main limitations. Land shaping and installing the distribution lines across the slope may be needed for septic tank absorption fields to operate properly. This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. As a result of the poor filtering capacity of this soil, groundwater supplies may become polluted.

The land capability classification of this soil is IIIs, and the Michigan soil management group is 4a.

62D—Ormas sand, 12 to 18 percent slopes. This is a rolling, well drained soil on high knolls and ridges. Individual areas of this soil are irregular in shape and range from 3 to 40 acres or more in size.

Typically, the surface layer is dark brown sand about 6 inches thick. The subsurface is yellowish brown sand about 14 inches thick. The subsoil is dark brown, friable sandy clay loam and sandy loam about 11 inches thick. The substratum to a depth of about 60 inches is yellowish brown, very gravelly sand. In places, the depth to the substratum is more than 45 inches. In places, the subsoil is less than 8 inches thick, or the sandy surface and subsurface layers are less than 20 inches thick.

Included with this soil in mapping are small areas of the excessively drained Plainfield soils and the somewhat excessively drained Mecosta soils in positions on the landscape similar to those of the Ormas soil. Also included are small areas of the somewhat poorly drained Wasepi soils on low knolls and side slopes and areas of the very poorly drained Gilford soils, which are in depressions and drainageways. The included soils make up about 5 to 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the soil and very rapid in the lower part. The available water capacity is low. Surface runoff is medium.

Most areas of this soil are used as woodland. A few areas are used as pasture or cropland.

This soil is poorly suited to use as cropland, but such crops as small grains and grass-legume hays can be grown. If this soil is used as cropland, increasing the content of organic matter, conserving soil moisture during dry periods, controlling water erosion and soil blowing, and overcoming equipment limitations associated with slope are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and supplemental additions of organic matter to the soil help to increase the available water capacity of the soil. Conservation tillage helps to overcome the water erosion hazard by reducing surface crusting and increasing the

rate of water infiltration. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. Farming on the contour minimizes equipment limitations associated with slope and helps to control erosion.

This soil is well suited to use as pasture. If this soil is used as pasture, controlling water erosion, conserving soil moisture during dry periods, and overcoming equipment limitations associated with slope are management concerns. Maintaining an adequate cover by preventing overgrazing helps control soil blowing, surface runoff, and water erosion. During the summer months, moisture in this soil is commonly insufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods.

This soil is well suited to use as woodland. If this soil is used as woodland, overcoming seedling mortality and plant competition are management concerns. Some seedling losses can be expected during dry summer months. The rate of seedling survival can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites. Slope is the main limitation for buildings. Buildings constructed on this soil should be designed to conform to the natural slope of the land.

This soil has medium potential for use as septic tank absorption fields. Slope and the poor filtering capacity of the soil are the main limitations. Land shaping and installation of distribution lines across the slope are generally needed for septic tank absorption fields to operate properly. This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in the pollution of groundwater supplies.

The land capability classification of this soil is IVs, and the Michigan soil management group is 4a.

63B—Remus-Spinks complex, 1 to 6 percent slopes. These are nearly level and undulating, well drained soils on knolls, ridges, and broad upland areas. The areas of these soils are so small or so intricately mixed that it was not practical to map them separately. The mapped areas are 40 to 60 percent Remus soil and 30 to 50 percent Spinks soil. The areas are irregular in shape and range from 10 to 1,400 acres or more in size.

Typically, the Remus soil has a surface layer of brown fine sandy loam about 7 inches thick. The next part, about 29 inches thick, is mixed brown sandy loam and dark yellowish brown loam. The subsoil, about 14 inches thick, is dark yellowish brown loam and dark brown sandy loam. The substratum to a depth of about 60 inches is brown, calcareous sandy loam. In some areas, the depth to the substratum is less than 40 inches, or the subsoil has more clay.

Typically, the Spinks soil has a surface layer of black loamy sand about 5 inches thick. The subsurface layer is yellowish brown and dark yellowish brown loamy sand about 15 inches thick. The next part to a depth of about 60 inches is yellowish brown sand that has 1/8- to 3-inch thick textural bands of dark brown loamy sand and sandy loam. In places, the textural bands are not present or the total accumulation of material in the bands is less than 6 inches. In places, the textural bands are loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Metamora and Thetford soils in shallow depressions and on side slopes. Also included are small areas of the poorly drained Corunna and Kingsville soils, which are in depressions and drainageways. The included soils make up 10 to 25 percent of the map unit.

Permeability is moderate in the Remus soil and moderately rapid in the Spinks soil. The available water capacity is moderate in the Remus soil and low in the Spinks soil. Surface runoff is medium on the Remus soil and very slow on the Spinks soil.

Most areas of these soils are used as cropland or woodland. A few areas are used as pasture.

These soils are moderately well suited to such crops as corn, small grains, beans, and grass-legume hays. If these soils are used as cropland, controlling water erosion and soil blowing, increasing the content of organic matter, and conserving soil moisture during dry periods are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to control water erosion by reducing surface crusting, thus increasing the rate of water infiltration. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. Conservation tillage and supplemental addition of organic matter to the soil help to increase content of organic matter in the soil and to increase the available water capacity of the soil. If water of sufficient quantity and quality is available, irrigation also helps to overcome the low available water concern. In some areas of these soils, pebbles and cobbles in the surface layer make seedbed preparation and harvesting difficult. Stones can be removed using a bulldozer or rock picker and then buried or stockpiled.

These soils are well suited to use as pasture. If these soils are used as pasture, conserving soil moisture during dry periods is a management concern in some areas of these soils. During summer months, the moisture content in some areas of these soils is

insufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing should be prevented, especially during dry periods, as it increases the susceptibility to soil blowing.

These soils are well suited to use as woodland. If these soils are used as woodland, overcoming seedling mortality and plant competition are management concerns. Some seedling losses can be expected in some areas of these soils during dry summer months. The rate of seedling survival can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

These soils have high potential for use as building sites and septic tank absorption fields. In the Remus soil, moderate permeability is a limitation to use as septic tank absorption fields. Enlarged septic tank absorption fields may be needed to control the permeability limitation.

The land capability classification of these soils is IIe, and the Michigan soil management groups are 2.5a and 4a.

63C—Remus-Spinks complex, 6 to 12 percent slopes. These are gently rolling, well drained soils on intermingled knolls, ridges, and broad upland areas. The areas of these soils are so small or so intricately mixed that it was not practical to map them separately. The mapped areas are 40 to 60 percent Remus soil and 30 to 50 percent Spinks soil. The areas are irregular in shape and range from 5 to 160 acres or more in size.

Typically, the Remus soil has a surface layer of dark brown fine sandy loam about 9 inches thick. The next part, about 29 inches thick, is mixed dark yellowish brown loam and brown sandy loam. The subsoil, about 14 inches thick, is dark yellowish brown loam and dark brown sandy loam. The substratum to a depth of about 60 inches is brown, calcareous sandy loam. In some areas, the depth to the substratum is less than 40 inches, or the subsoil has more clay.

Typically, the Spinks soil has a surface layer of black loamy sand about 5 inches thick. The subsurface layer is yellowish brown and dark yellowish brown loamy sand about 15 inches thick. The next part to a depth of about 60 inches is yellowish brown sand that has 1/8- to 3-inch thick textural bands of dark brown loamy sand and sandy loam. In places, the textural bands are not present or the total accumulation of textural material is less than 6 inches. In places, the textural bands are loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Metamora and Thetford soils in shallow depressions and on side slopes. Also included are small areas of the poorly drained Corunna and Kingsville soils, which are in depressions and drainageways. The included soils make up 10 to 25 percent of the map unit.

Permeability is moderate in the Remus soil and moderately rapid in the Spinks soil. The available water capacity is moderate in the Remus soil and low in the Spinks soil. Surface runoff is medium on the Remus soil and very slow on the Spinks soil.

Most areas of these soils are used as cropland or woodland. A few areas are used as pasture.

These soils are moderately well suited to such crops as corn, small grains, beans, and grass-legume hays. If these soils are used as cropland, controlling water erosion and soil blowing, increasing the content of organic matter in the soil, and conserving soil moisture during dry periods are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to control water erosion by reducing surface crusting and increasing water infiltration. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. Conservation tillage and supplemental addition of organic matter to the soil help to increase content of organic matter and the available water capacity of the soil. In some places, these soils have enough pebbles and cobbles in the surface layer to make seedbed preparation and harvesting difficult. Stones can be removed using a bulldozer or rock picker and then buried or stockpiled.

These soils are well suited to use as pasture. If these soils are used as pasture, water erosion is a hazard. Conserving soil moisture during dry periods is a management concern in some areas of these soils. Maintaining an adequate cover by preventing overgrazing helps control surface runoff, water erosion, and soil blowing. During the summer months, the content of soil moisture in some areas of these soils is insufficient for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods.

These soils are well suited to use as woodland. If these soils are used as woodland, seedling mortality and plant competition are management concerns. Some seedling losses can be expected in some areas of these soils during dry summer months. The rate of seedling survival can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

These soils have high potential for use as building sites. Slope is the main limitation for buildings. Buildings constructed on these soils should be designed to conform to the natural slope of the land. Land shaping may be necessary in some areas.

These soils have high potential for use as septic tank absorption fields. Slope is the main limitation on the Spinks soil, and slope and the moderate permeability of the soil are the main limitations on the Remus soil. Enlarged septic tank absorption fields placed on the contour may be needed to control the limitations of permeability and slope. Slopes should be stabilized to prevent erosion and the possible surfacing of effluent.

The land capability classification of these soils is IIIe, and the Michigan soil management groups are 2.5a and 4a.

63D—Remus-Spinks complex, 12 to 18 percent slopes. These are rolling, well drained soils on high knolls and ridges. The areas of these soils are so small or so intricately mixed that it was not practical to map them separately. The mapped areas are 40 to 60 percent Remus soil and 30 to 50 percent Spinks soil. The areas are irregular in shape and range from 5 to 100 acres or more in size.

Typically, the Remus soil has a surface layer of dark brown fine sandy loam about 9 inches thick. The next part, about 22 inches thick, is mixed brown sandy loam and yellowish brown loam. The subsoil, about 21 inches thick, is dark yellowish brown loam and dark brown sandy loam. The substratum to a depth of about 60 inches is brown, calcareous sandy loam. In some areas, the depth to the substratum is less than 40 inches, or the subsoil has more clay.

Typically, the Spinks soil has a surface layer of black loamy sand about 3 inches thick. The subsurface layers are yellowish brown and dark yellowish brown loamy sand about 15 inches thick. The next part, to a depth of about 60 inches, is yellowish brown sand that has 1/8- to 3-inch thick textural bands of dark brown loamy sand and sandy loam. In places, the textural bands are not present or the total accumulation of textural material is less than 6 inches. In places, the textural bands are loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Metamora and Thetford soils in shallow depressions and on side slopes. Also included are small areas of the poorly drained Corunna and Kingsville soils, which are in depressions and drainageways. The included soils make up 10 to 25 percent of the map unit.

Permeability is moderate in the Remus soil and moderately rapid in the Spinks soil. The available water capacity is moderate in the Remus soil and low in the Spinks soil. Surface runoff is rapid on the Remus soil and medium on the Spinks soil.

Most areas of these soils are used as woodland. A few areas are used as pasture.

These soils are poorly suited to use as cropland, but such crops as corn, small grains, and grass-legume hays can be grown. If these soils are used as cropland, controlling water erosion and soil blowing, increasing the content of organic matter in the soil, and conserving soil moisture during dry periods are management concerns. Slope is a limitation on the use of equipment. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to control water erosion by reducing surface crusting and increasing water infiltration. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. Conservation tillage and supplemental addition of organic matter to the soil help to increase content of organic matter and the available water capacity of the soil. In some places, these soils have enough pebbles and cobbles in the surface layer to make seedbed preparation and harvesting difficult. Stones can be removed using a bulldozer or rock picker and then buried or stockpiled. Farming on the contour minimizes equipment limitations associated with slope and helps control erosion.

These soils are moderately well suited to use as pasture. If these soils are used as pasture, water erosion is a hazard. Conserving soil moisture during dry periods is a management concern in some areas of these soils. Maintaining an adequate cover by preventing overgrazing helps control surface runoff, water erosion, and soil blowing. During the summer months, some areas of these soils have insufficient moisture for optimum plant growth. Rotational or strip grazing and restricting use help maintain production during dry periods.

These soils are well suited to use as woodland. If these soils are used as woodland, seedling mortality and plant competition are management concerns. Some seedling losses can be expected in some areas of these soils during the dry summer months. The rate of seedling survival can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

These soils have medium potential for use as building sites. Slope is the main limitation to use of these soils as building sites. Buildings constructed on these soils should be designed to conform to the natural slope of the land. Land shaping may be necessary in some areas.

These soils have medium potential for use as septic tank absorption fields. The main limitations are slope on the Spinks soil and slope and moderate permeability on the Remus soil. Land shaping and installation of the distribution lines across the slope may be necessary for proper operation of the septic tank absorption fields. Enlarged septic tank absorption fields or dual alternating absorption fields may be needed because of the moderate permeability of the Spinks soil. Slopes should be stabilized to prevent erosion and surfacing of the effluent.

The land capability classification of these soils is IVe, and the Michigan soil management groups are 2.5a and 4a.

63E—Remus-Spinks complex, 18 to 35 percent slopes. This map unit consists of hilly and very hilly, well drained soils intermingled on hills and ridges. The areas of these soils are so small or so intricately mixed that it was not practical to map them separately. The mapped areas are 40 to 60 percent Remus soil and 30 to 50 percent Spinks soil. The areas are irregular in shape and range from 10 to 60 acres or more in size.

Typically, the Remus soil has a surface layer of brown fine sandy loam about 3 inches thick. The next part, about 22 inches thick, is mixed brown sandy loam and dark yellowish brown loam. The subsoil, about 21 inches thick, is dark yellowish brown loam and dark brown sandy loam. The substratum to a depth of about 60 inches is brown, calcareous loam. In some areas, the depth to the substratum is less than 40 inches, or the subsoil has more clay.

Typically, the Spinks soil has a surface layer of black loamy sand about 3 inches thick. The subsurface layer is yellowish brown and dark yellowish brown loamy sand about 15 inches thick. The next part to a depth of about 60 inches is yellowish brown sand that has 1/8- to 3-inch thick textural bands of dark brown loamy sand and sandy loam. In places, the textural bands are not present or the total accumulation of material in the bands is less than 6 inches. In places, the textural bands are loam.

Included with the Remus and Spinks soils in mapping are small areas of the somewhat poorly drained Metamora and Thetford soils in shallow depressions and on side slopes. Also included are small areas of the poorly drained Corunna and Kingsville soils, which are in depressions and drainageways. The included soils make up 10 to 25 percent of the map unit.

Permeability is moderate in the Remus soil and moderately rapid in the Spinks soil. The available water capacity is moderate in the Remus soil and low in the Spinks soil. Surface runoff is rapid.

Most areas of these soils are used as woodland. A few areas are used as pasture.

The soils in this map unit are generally not suited to cultivated crops or to pasture because of the hilly slopes and the hazard of water erosion and soil blowing.

These soils are well suited to use as woodland. If these soils are used as woodland, overcoming water erosion, equipment limitations, and plant competition are management concerns. Seedling mortality is an additional management concern in some areas of these soils. To overcome the hazard of erosion, roads, skid trails, and landings should be located on gentle grades and water removal should be facilitated without the use of sloping road surfaces, culverts, and drop structures. The use of crawlers and rubber-tired tractors can be unsafe because of the steep slope. Special operations, such as yarding logs uphill with a cable, may be needed. Special harvesting methods and site preparation may be needed to control competition from undesirable plants. Some seedling losses can be expected in some areas of these soils during dry summer months. The rate of seedling survival can be improved by the use of special planting stock and by special site preparation, such as contour furrowing before planting or applying herbicides.

These soils have medium to low potential for use as building sites because of slope. Buildings constructed on these soils should be designed to conform to the natural slope of the land. Land shaping commonly is needed in most areas.

These soils have low potential for use as septic tank absorption fields because of slope and, in some areas of the Remus soil, moderate permeability. Land shaping and installation of the distribution lines across the slope generally are needed for septic tank absorption fields to operate properly. Enlarged septic tank absorption fields or dual alternating absorption fields may be needed because of the moderate permeability in the Remus soil. Corrective measures on these soils are expensive, and commonly some degree of limitation remains. Slopes should be stabilized to prevent erosion and surfacing of effluent.

The land capability classification of these soils is VIe, and the Michigan soil management groups are 2.5a and 4a.

65B—Arkport loamy fine sand, 1 to 6 percent slopes. This is a nearly level and undulating, well drained soil on knolls, ridges, and broad upland areas. Individual areas of this soil are irregular in shape and range from 3 to 100 acres or more in size.

Typically, the surface layer is dark brown loamy fine sand about 7 inches thick. The subsurface layer is yellowish brown loamy fine sand about 4 inches thick. The next part, about 5 inches thick, is mixed, pale brown loamy fine sand and dark yellowish brown fine sandy loam. The next part, about 7 inches thick, is mixed dark brown loam and brown loamy fine sand. The next part, about 18 inches thick, is mixed yellowish brown loamy very fine sand textural bands and light yellowish brown fine sand. The lower part, about 16 inches thick, is light yellowish brown loamy very fine sand and very fine sandy loam. The substratum to a depth of about 60 inches is light yellowish brown fine sand. In places, the textural bands contain less clay or the depth to the substratum is less than 40 inches. In places, the depth to the uppermost lamellae is less than 15 inches or more than 30 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Minoa and Thetford soils on low knolls and side slopes. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately rapid. The available water capacity is moderate. Surface runoff is very slow or slow.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, controlling water erosion and soil blowing and increasing the content of organic matter in the soil are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to control water erosion by reducing surface crusting and increasing the rate of water infiltration. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. Conservation tillage and supplemental additions of organic matter to the soil help to increase the content of organic matter in the soil.

This soil is well suited to use as pasture. Overgrazing should be prevented, especially during dry periods, as it increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, overcoming plant competition is a management concern. Special harvesting methods and site preparations may be needed to control competition from undesirable plants.

This soil is well suited to use as building sites and to septic tank absorption fields. There are no major management concerns.

The land capability classification of this soil is IIe, and the Michigan soil management group is 3a-s.

65C—Arkport loamy fine sand, 6 to 12 percent slopes. This is a gently rolling, well drained soil on knolls and ridges. Individual areas of this soil are irregular in shape and range from 3 to 40 acres or more in size.

Typically, the surface layer is dark brown loamy fine sand about 7 inches thick. The subsurface layer is yellowish brown loamy fine sand about 4 inches thick. The next part, about 4 inches thick, is mixed pale brown loamy fine sand and dark yellowish brown fine sandy loam. The next part, about 6 inches thick, is mixed dark brown loam and brown loamy fine sand. The next part, about 18 inches thick, is mixed yellowish brown loamy very fine sand and light yellowish brown fine sand. The lower part, about 15 inches thick, is light yellowish brown loamy very fine sand and very fine sandy loam. The substratum to a depth of about 60 inches is light yellowish brown fine sand. In places, the textural bands contain less clay, or the depth to the substratum is less than 40 inches. In places, the depth to the uppermost lamellae is less than 15 inches or more than 30 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Minoa and Thetford soils on low knolls and side slopes. Also included are the poorly drained Kingsville and Lamson soils in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately rapid. The available water capacity is moderate. Surface runoff is slow.

Most areas of this soil are used as cropland or pasture. A few areas are used as woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hays. If this soil is used as cropland, controlling water erosion and soil blowing and increasing the content of organic matter in the soil are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to control water erosion by reducing surface crusting and increasing the rate of water infiltration. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. Conservation tillage and supplemental additions of organic matter to the soil help to maintain or increase the content of organic matter in the soil.

This soil is well suited to use as pasture. If this soil is used as pasture, controlling water erosion is a management concern. Maintaining an adequate cover by preventing overgrazing helps to control surface runoff and erosion. Overgrazing during dry periods increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, plant competition is a management concern. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites and septic tank absorption fields. Slope is the major management concern. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be necessary in some areas. In some places, septic tank absorption field distribution lines can be placed on the contour. Slopes should be stabilized to prevent erosion.

The land capability classification of this soil is IIIe, and the Michigan soil management group is 3a-s.

66B—Woodbeck-Coloma complex, 1 to 6 percent slopes. This map unit consists of nearly level and undulating, well drained Woodbeck soil and somewhat excessively drained Coloma soil. The Woodbeck soil is on knolls and ridgetops. The Coloma soil is on side slopes and in slight depressions. The areas of these soils are so small or so intricately mixed that it was not possible to map them separately. The mapped areas are 40 to 60 percent Woodbeck soil and 30 to 50 percent Coloma soil. The areas are irregular in shape and range from 80 to 200 acres or more in size (fig. 13).

Figure 13.--An area of Woodbeck-Coloma complex. The light colored area in the background is the Coloma soil.

Typically; the Woodbeck soil has a surface layer of dark brown loam about 8 inches thick. The next part, about 16 inches thick, is mixed dark brown clay loam and brown sandy loam. The next part, about 16 inches thick, is dark yellowish brown loamy sand. The lower part to a depth of about 60 inches is light yellowish brown loamy sand that has 1/8- to 1/4-inch thick textural bands of dark brown loamy sand. In some areas, the depth to the substratum is less than 60 inches, or there is less clay in the subsoil.

Typically, the Coloma soil has a surface layer of dark brown sand about 11 inches thick. The subsurface layer is yellowish brown sand about 30 inches thick. The next part to a depth of about 60 inches is light yellowish brown, loose sand that has 1/8- to 1/4-inch thick textural bands of strong brown, very friable loamy sand. In places, the textural bands are not present or the total accumulation of material in the textural bands is more than 6 inches. In places, the solum is fine sand, and in places, the pebble content of the solum is more than 10 percent.

Included with these soils in mapping are small areas of the somewhat poorly drained Ithaca and Thetford soils in shallow depressions and on side slopes. Also included are small areas of the poorly drained Ziegenfuss soils, which are in depressions and drainageways. The included soils make up 3 to 15 percent of the map unit.

Permeability is moderately slow in the upper part of the Woodbeck soil and rapid in the lower part. Permeability is rapid in the Coloma soil. The available water capacity is moderate in the Woodbeck soil and low in the Coloma soil. Surface runoff is medium on the Woodbeck soil and very slow on the Coloma soil. The Woodbeck soil has moderate shrink-swell potential in the subsoil.

Most areas of these soils are used as cropland. A few areas are used as woodland or for hay and pasture.

These soils are moderately well suited to such crops as corn, small grains, beans, and grass-legume hay. If these soils are used as cropland, controlling water erosion and soil blowing and maintaining good soil tilth are management concerns. In addition, increasing organic matter content and conserving soil moisture during dry periods are also management concerns. Practices used to control water erosion include conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and the use of close-growing crops in the cropping system. Conservation tillage reduces surface compaction and increases the rate of water infiltration. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. Performing tillage operations at the proper soil

moisture content prevents clods from forming and the soil from becoming compacted. It also helps to maintain good tilth, as do conservation tillage and supplemental additions of organic matter to the soil. Conservation tillage and supplemental additions of organic material to the soil also help increase the content of organic matter in the soil.

These soils are well suited to use as pasture. If these soils are used as pasture, controlling water erosion and preventing soil compaction are management concerns on some areas of these soils. Conserving soil moisture during dry periods is a management concern in some areas. Maintaining a cover by preventing overgrazing helps control surface runoff and erosion. In some areas, overgrazing or grazing when the soils are too wet can cause soil compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition. In some areas, overgrazing during dry periods increases the soil's susceptibility to soil blowing.

These soils are well suited to use as woodland. If these soils are used as woodland, management concerns are seedling mortality and plant competition. Some seedling losses can be expected in some areas during dry summer months. The rate of seedling survival can be improved by the use of special planting stock and by special site preparations, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

These soils have high potential for use as building sites and septic tank absorption fields. Limitations to the use of these soils for septic tank absorption fields are, in the Woodbeck soil, the moderately slow permeability throughout and the poor filtering capacity in the lower part of the soil; and in the Coloma soil, the poor filtering capacity of the soil. Enlarged septic tank absorption fields or dual alternating absorption fields may be needed to control the permeability limitation in the upper part of the Woodbeck soil. The Coloma soil and the lower part of the Woodbeck soil readily absorb effluent from septic tank absorption fields, but do not adequately filter the effluent. The poor filtering capacity may result in the pollution of groundwater supplies. Seepage should be monitored by periodically testing wells for contamination.

The land capability classification of these soils is IIe, and the Michigan soil management groups are 1/5a and 5a.

66C—Woodbeck-Coloma complex, 6 to 12 percent slopes. This map unit consists of gently rolling, well drained Woodbeck soil and somewhat excessively drained Coloma soil. The Woodbeck soil is on side slopes and ridgetops. The Coloma soil is on side slopes and in slight depressions. The areas of these soils are so small or so intricately mixed that it was not practical to map them separately. The mapped areas are 40 to 60 percent Woodbeck soil and 30 to 50 percent Coloma soil. The areas are irregular in shape and range from 10 to 60 acres or more in size.

Typically, the Woodbeck soil has a surface layer of dark brown loam about 8 inches thick. The next part, about 16 inches thick, is mixed dark brown clay loam and brown sandy loam. The next part, about 16 inches thick, is dark yellowish brown, very friable loamy sand. The lower part is light yellowish brown loamy sand that has 1/8- to 1/4-inch thick textural bands of dark brown loamy sand. In some areas, the depth to the substratum is less than 60 inches, or there is less clay in the subsoil.

Typically, the Coloma soil has a surface layer of dark brown sand about 9 inches thick. The subsurface layer is yellowish brown sand about 30 inches thick. The next part to a depth of about 60 inches is light yellowish brown, loose sand that has 1/8- to 1/4-inch thick textural bands of strong brown, very friable loamy sand. In places, the textural bands are not present, or the total accumulation of material in the textural bands is more than 6 inches. In places, the solum is fine sand, or the pebble content of the solum is more than 10 percent.

Included with these soils in mapping are small areas of the somewhat poorly drained Ithaca and Thetford soils in shallow depressions and on side slopes. Also included are small areas of the poorly drained Ziegenfuss soils, which are in depressions and drainageways. The included soils make up 2 to 15 percent of the map unit.

Permeability is moderately slow in the upper part of the Woodbeck soil and rapid in the lower part. Permeability is rapid in the Coloma soil. The available water capacity is moderate in the Woodbeck soil and low in the Coloma soil. Surface runoff is medium on the Woodbeck soil and slow on the Coloma soil. The Woodbeck soil has moderate shrink-swell potential in the subsoil.

Most areas of these soils are used as cropland. A few areas are used as woodland or for hay and pasture.

These soils are moderately well suited to such crops as corn, small grains, beans, and grass-legume hay. If these soils are used as cropland, controlling water erosion and soil blowing, and maintaining good soil tilth, conserving soil moisture during dry periods, and increasing the content of organic matter in the soil are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps control hazard of water erosion by reducing surface crusting and increasing the rate of water infiltration. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. Performing tillage operations at the proper moisture content prevents clods from forming and the

soils from becoming compacted. It also helps to maintain good tilth, as do conservation tillage and supplemental additions of organic matter to the soil. These practices also help to increase the available water capacity of the soils.

These soils are well suited to use as pasture. If these soils are used as pasture, controlling water erosion and minimizing soil compaction are management concerns in some areas. Conserving soil moisture during dry periods is a management concern in other areas. Maintaining an adequate cover by preventing overgrazing helps control surface runoff and erosion. In some areas of these soils, overgrazing or grazing when the soil is too wet can cause soil compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition. During the summer months, some areas of these soils do not have sufficient soil moisture for optimum plant growth. Rotational or strip grazing and restricted use help maintain production during dry periods. Overgrazing during dry periods increases the soil's susceptiblity to soil blowing in some areas.

These soils are well suited to use as woodland. If these soils are used as woodland, management concerns are seedling mortality and plant competition. Some seedling losses can be expected in some areas during dry summer months. The rate of seedling survival can be improved by the use of special planting stock and by special site preparation, such as furrowing before planting or applying herbicides. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

These soils have high potential for use as building sites. Slope is the major management concern. Buildings constructed on these soils should be designed to conform to the natural slope of the land. Land shaping may be necessary in some areas.

The Woodbeck soil has medium potential and the Coloma soil has high potential for use as septic tank absorption fields. The moderately slow permeability in the upper part of the Woodbeck soil and the poor filtering capacity in the lower part are the main management concerns. Enlarged septic tank absorption fields or dual alternating absorption fields on the contour may be needed to overcome the permeability and slope limitations. The Coloma soil and the lower part of the Woodbeck soil readily absorb effluent from septic tank absorption fields but do not adequately filter the effluent. The poor filtering capacity may result in the pollution of groundwater supplies. Seepage should be monitored by periodically testing wells for contamination. Slopes should be stabilized to prevent erosion.

The land capability classification of these soils is IIIe, and the Michigan soil management groups are 1/5a and 5a.

67B—Remus sandy loam, 1 to 6 percent slopes. This is a nearly level and undulating, well drained soil on knolls, ridges, and broad upland areas. Individual areas of this soil are irregular in shape and range from 3 to 100 acres or more in size.

Typically, the surface layer is brown sandy loam about 8 inches thick. The next part, about 25 inches thick, is dark yellowish brown and yellowish brown fine sandy loam. The subsoil, about 14 inches thick, is brown loamy sand. The next part, about 18 inches thick, is mixed dark brown loamy sand and sandy loam. The substratum to a depth of about 60 inches is brown, calcareous loam. In some areas, the depth to the substratum is less than 40 inches. In places, the subsoil has more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Metamora soils in shallow depressions and on side slopes. Also included are small areas of the poorly drained Corunna soils, which are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderate. The available water capacity is high. Surface runoff is medium.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, controlling water erosion and soil blowing and increasing the content of organic matter are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to control water erosion by reducing surface crusting and increasing water infiltration. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. Conservation tillage and supplemental additions of organic matter to the soil help to increase the organic matter content of the soil.

This soil is well suited to use as pasture. Overgrazing during dry periods increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, plant competition is a management concern. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites and septic tank absorption fields. There are few limitations to use of this soil as building sites. Moderate permeability is the major concern in areas used for septic tank absorption fields. Enlarged septic tank absorption fields may be needed to overcome the permeability limitation.

The land capability classification of this soil is IIe, and the Michigan soil management group is 3a.

67C—Remus sandy loam, 6 to 12 percent slopes. This is a gently rolling, well drained soil on knolls, ridges, and broad upland areas. Individual areas of this soil are irregular in shape and range from 3 to 20 acres or more in size.

Typically, the surface layer is brown sandy loam about 7 inches thick. The next part, about 25 inches thick, is dark yellowish brown and yellowish brown fine sandy loam. The subsoil, about 14 inches thick, is brown loamy sand. The next part, about 18 inches thick, is mixed dark brown loamy sand and sandy loam. The substratum to a depth of about 60 inches is brown, calcareous loam. In some areas, the depth to the substratum is less than 40 inches, or the subsoil has more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Metamora soils in shallow depressions and side slopes. Also included are small areas of the poorly drained Corunna soils, which are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderate. The available water capacity is high. Surface runoff is medium.

Most areas of this soil are used as cropland. A few areas are used as pasture or woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hay. If this soil is used as cropland, controlling water erosion and soil blowing and increasing the content of organic matter are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps control water erosion by reducing surface crusting and increasing the rate of water infiltration. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. Conservation tillage and supplemental additions of organic matter to the soil help to increase the content of organic matter in the soil.

This soil is well suited to use as pasture. If this soil is used as pasture, water erosion is a management concern. Maintaining cover by preventing overgrazing helps control surface runoff and erosion. Overgrazing during dry periods increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, plant competition is a management concern. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has high potential for use as building sites. Slope is the major concern in areas of this soil used for buildings. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be necessary in some areas. This soil has high potential for use as septic tank absorption fields. Slope and the moderate permeability of the soil are the main limitations to this use. Enlarged septic tank absorption fields placed on the contour may be needed to control the permeability and slope limitations. Slopes should be stabilized to prevent erosion and the surfacing of effluent.

The land capability classification of this soil is IIIe, and the Michigan soil management group is 3a.

67D—Remus sandy loam, 12 to 18 percent slopes. This is a rolling, well drained soil on high knolls and ridges. Individual areas of this soil are irregular in shape and range from 3 to 100 acres or more in size.

Typically, the surface layer is brown sandy loam about 6 inches thick. The next part, about 23 inches thick, is dark yellowish brown and yellowish brown fine sandy loam. The subsoil, about 12 inches thick, is brown loamy sand. The next part, about 17 inches thick, is mixed dark brown loamy sand and sandy loam. The substratum to a depth of about 60 inches is brown, calcareous loam. In some areas, the depth to the substratum is less than 40 inches, or the subsoil has more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Metamora soils in shallow depressions and on side slopes. Also included are small areas of the poorly drained Corunna soils, which are in depressions and drainageways. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderate. The available water capacity is high. Surface runoff is rapid.

Most areas of this soil are used as woodland. A few areas are used as pasture or cropland.

This soil is poorly suited to use as cropland, but such crops as corn, small grains, and grass-legume hay can be grown. If this soil is used as cropland, controlling water erosion and soil blowing, increasing the content of organic matter, and overcoming equipment limitations caused by slope are management concerns. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps control the hazard of water erosion by reducing surface crusting and increasing the rate of water infiltration. Including close-growing crops in the cropping system also helps to control erosion. Grassed waterways, diversions, and drop structures help prevent gullying. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing. Conservation tillage and supplemental additions of organic matter to the soil help to increase the content of organic matter in the soil. Farming should be done on the contour to minimize equipment limitations caused by slope and to help control erosion.

This soil is moderately well suited to use as pasture. If this soil is used as pasture, controlling water erosion and overcoming equipment limitations caused by slope are management concerns. Maintaining cover by preventing overgrazing helps control surface runoff and erosion.

Overgrazing during dry periods increases the soil's susceptibility to soil blowing.

This soil is well suited to use as woodland. If this soil is used as woodland, plant competition is a management concern. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has medium potential for use as building sites. Slope is the main limitation in areas of this soil used for buildings. Buildings constructed on this soil should be designed to conform to the natural slope of the land. Land shaping may be necessary in some areas.

This soil has medium potential for use as septic tank absorption fields. Slope and the moderate permeability of the soil are the main limitations to septic tank absorption fields. Land shaping and installation of distribution lines across the slope may be necessary for septic tank absorption fields to operate properly. Enlarged septic tank absorption fields or dual alternating absorption fields may be needed to overcome the moderate permeability limitation. Slopes should be stabilized to prevent erosion and the surfacing of effluent.

The land capability classification of this soil is IVe, and the Michigan soil management group is 3a.

70B—Ithaca-Selfridge complex, 0 to 4 percent slopes. This map unit consists of the nearly level and undulating, somewhat poorly drained Ithaca soil on low knolls and ridges and the nearly level, somewhat poorly drained Selfridge soil on knolls and ridges. The areas of these soils are so small or so intricately mixed that it was not practical to map them separately. The mapped areas are 50 to 70 percent Ithaca soil and 20 to 40 percent Selfridge soil. The areas are irregular in shape and range from 10 to 160 acres or more in size.

Typically, the Ithaca soil has a surface layer of dark brown loam about 10 inches thick. The next part, about 4 inches thick, is mixed dark brown clay loam and brown loam. The subsoil, about 16 inches thick, is dark brown clay loam. The substratum to a depth of about 60 inches is brown, mottled, calcareous clay loam. In some areas, the mixed layer beneath the surface layer is not present, or it has been destroyed by plowing. In places, the depth to the substratum is less than 20 inches, or there is less clay in the subsoil.

Typically, the Selfridge soil has a surface layer of dark brown sand about 9 inches thick. The subsurface layer is yellowish brown sand about 21 inches thick. The subsoil, about 8 inches thick, is dark yellowish brown, mottled, very friable sandy loam in the upper part and dark brown, mottled, friable clay loam in the lower part. The substratum to a depth of about 60 inches is brown, mottled, calcareous clay loam. In places, there is less clay in the subsoil. In places, the depth to the substratum is less than 24 inches or more than 40 inches. In places, the surface layer is more than 10 inches thick, or it is sandy loam. In some areas, iron, aluminum, and organic matter have accumulated in the subsoil. In some places, a 1- to 6-inch thick layer of very fine sand and silt is above the substratum.

Included with these soils in mapping are small areas of the poorly drained Ziegenfuss and Parkhill soils, which are in depressions and drainageways. The included soils make up 10 to 20 percent of the map unit.

Permeability is moderately slow in the Ithaca soil. It is rapid in the upper part of the Selfridge soil and moderately slow in the lower part. The available water capacity is high in the Ithaca soil and moderate in the Selfridge soil. Surface runoff is slow or medium on the Ithaca soil and very slow or slow on the Selfridge soil. In the Ithaca soil, the seasonal high water table is at a depth of 1 foot to 2 feet from autumn to spring; and in the Selfridge soil, it is at a depth of 1 foot to 2 feet from winter to spring. The Ithaca soil has moderate shrink-swell potential in the subsoil and substratum. The Selfridge soil has moderate shrink-swell potential in the substratum.

Most areas of these soils are used as cropland. A few areas are used as pasture or woodland.

These soils are moderately well suited to such crops as corn, small grains, beans, and grass-legume hay. If these soils are used as cropland, removing excess water during wet periods is a management concern. Maintaining soil tilth, controlling soil blowing, and increasing the content of organic matter are management concerns in some areas of these soils. A combined surface and subsurface drainage system helps to control wetness. Shallow surface ditches effectively remove surface water, and subsurface drainage helps to lower the high water table. Erosion control structures may be needed where the surface ditches enter other drainageways. Tilling these soils at the proper moisture content prevents clods from forming and the soil from becoming compacted. It also helps to maintain good soil tilth, as do conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface and supplemental additions of organic matter to the soil. Conservation tillage, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing.

These soils are well suited to use as pasture. If these soils are used as pasture, wetness from autumn to spring is a management concern. Soil compaction is a management concern in some areas of these soils. Only those species of pasture plants that tolerate wetness should be planted. Overgrazing or grazing when the soil is too wet can cause soil compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

These soils are well suited to use as woodland. If these soils are used as woodland, windthrow, plant competition, and equipment limitations are management

concerns. The hazard of windthrow can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

These soils have medium potential for use as building sites. Wetness and shrink-swell potential are the major limitations to use of these soils as sites for buildings. If buildings with basements are constructed, the building site should be raised, using well compacted suitable fill material. Maintenance of an artificial drainage system and the installation and maintenance of a sump pump may be needed. Yard use may need to be restricted during wet periods.

The Ithaca soil has low potential for use as septic tank absorption fields, and the Selfridge soil has medium potential. Moderately slow permeability and wetness are the main limitations to this use. If a septic tank disposal system is constructed, the absorption field may have to be placed on suitable fill material and a clay barrier may be needed to raise the field above the seasonal high water table and to prevent the surfacing of effluent.

The land capability classification of these soils is IIw, and the Michigan soil management groups are 1.5b and 4/2b.

71—Cohoctah fine sandy loam, occasionally flooded. This is a nearly level, poorly drained soil on the flood plains of rivers and streams. This soil is occasionally flooded. Individual areas are long and narrow or irregular in shape and commonly are bordered by escarpments on the upland side. The areas range from 10 to 100 acres or more in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 10 inches thick. The substratum extends to a depth of 60 inches or more. It is dark grayish brown, mottled loam in the upper part; strong brown, mottled sandy loam overlying yellowish brown, mottled loamy sand in the middle part; and multicolored sand and gravel and brown, mottled silty clay loam in the lower part. In places, there is more or less clay in the substratum than is typical.

Included with this soil in mapping are small areas of the somewhat poorly drained Algansee and Shoals soils that are slightly higher on the landscape than the Cohoctah soil. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the soil and rapid in the lower part. The available water capacity is high. Surface runoff is very slow. The seasonal high water table is at a depth of 1 foot or less from autumn to spring.

Most areas of this soil are used as cropland. A few areas are used as pasture and woodland.

This soil is moderately well suited to such crops as corn, small grains, beans, and grass-legume hay if adequate drainage is provided. If this soil is used as cropland, removing excess water and controlling soil blowing are management concerns. Artificial drainage is needed for optimum crop production. A combined surface and subsurface drainage sytem helps control wetness. If drainage outlets are available, shallow surface ditches effectively remove surface water and subsurface drainage helps to lower the high water table. Erosion control structures may be needed where the surface ditches enter other drainageways. Lift pumps may be needed in some areas to provide drainage outlets. To prevent tile lines from filling with fine sand, barriers of suitable material should be constructed. Conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface, cover crops, buffer strips, and field windbreaks are practices used to control soil blowing.

This soil is well suited to use as pasture. If this soil is used as pasture, wetness is a management concern. Only those species of pasture plants that tolerate wetness should be planted.

This soil is moderately well suited to use as woodland. If this soil is used as woodland, windthrow, equipment limitations, seedling mortality, and plant competition are management concerns. The hazard of windthrow can be minimized by harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of planting or logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Seedling losses may be high because of wetness. Special site preparation, such as bedding before planting or applying herbicides, may improve the rate of seedling survival. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has low potential for use as building sites and very low potential for use as septic tank absorption fields. Flooding, wetness, and the poor filtering capacity of the soil are the main management concerns. Overcoming these limitations is difficult and very costly.

The land capability classification of this soil is IIIw, and the Michigan soil management group is L-2c.

74—Shoals silt loam. This is a nearly level, somewhat poorly drained soil on flood plains. This soil is occasionally flooded by stream overflow for brief periods. Individual areas are irregular in shape and are commonly bordered by escarpments on the upland side. The areas range from 40 to 160 acres or more in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The mottled substratum extends to a depth of 60 inches or more. It consists of four distinct layers: dark brown silt loam, yellowish brown silt loam, brown stratified sand and sandy loam, and stratified grayish brown clay loam, sandy loam, and gravelly sand. In places, the substratum is darker, or it contains less silt and clay. In places, there is more clay in the lower substratum.

Included with this soil in mapping are small areas of the poorly drained Cohoctah soils that are slightly lower on the landscape than the Shoals soil. The included soils make up 0 to 15 percent of the map unit.

Permeability is moderate. The available water capacity is high. Surface runoff is very slow or slow. The seasonal high water table is at a depth of 1 foot to 2 feet during winter and spring.

Most areas of this soil are used as woodland or cropland. A few areas are used as pasture. This soil is well suited to such crops as corn, small grains, beans, and grass-legume hay if it is protected from flooding and adequate drainage is provided.

If this soil is used as cropland, flooding is a hazard. Removing excess water during wet periods and maintaining good soil tilth are management concerns. Providing for good surface drainage, so that late crops can be planted after flood waters recede, helps overcome the hazard of flooding. A combined surface and subsurface drainage system helps to control wetness. If drainage outlets are available, shallow surface ditches effectively remove surface water and subsurface drainage helps to lower the high water table. Erosion control structures may be needed where surface ditches enter other drainageways. Performing tillage operations at the proper soil moisture content prevents clods from forming and the soil from becoming compacted. It also helps to maintain good soil tilth, as does conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface, planting cover crops, and supplemental additions of organic matter to the soil.

This soil is well suited to use as pasture if it is protected from flooding. If this soil is used as pasture, flooding, wetness, and soil compaction are management concerns. Providing for surface drainage and restricting use during the flood season help overcome the hazard of flooding. Only those species of pasture plants that tolerate wetness should be planted. Overgrazing or grazing this soil when it is too wet can cause surface compaction and destroy forage plants. A proper stocking rate, rotational or strip grazing, and restricting use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to use as woodland. If this soil is used as woodland, windthrow, equipment limitations, and plant competition are management concerns. The hazard of windthrow can be minimized by using harvesting methods that do not leave the remaining trees standing alone or widely spaced. The use of logging equipment is restricted during wet periods, but woodland operations can be performed when the soil is relatively dry or frozen. Special harvesting methods and site preparation may be needed to control competition from undesirable plants.

This soil has low potential for use as building sites and very low potential for use as septic tank absorption fields. Flooding and wetness are the main management concerns. These limitations are difficult and very costly to overcome.

The land capability classification of this soil is IIw, and the Michigan soil management group is L-2c.

Prime Farmland

In this section, prime farmland is defined and discussed, and the prime farmland soils in Isabella County are listed.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not subject to frequent flooding during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table, are subject to flooding, or are droughty may quality as prime farmland soils if the limitations or hazards are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

A recent trend in land use in some parts of the county has been the conversion of some prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are wet, more erodible, droughty, or difficult to cultivate and less productive than prime farmland.

The following map units, or soils, make up prime farmland in Isabella County. On some soils included in the list, appropriate measures have been applied to overcome a hazard or limitation, such as flooding, wetness, or droughtiness. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

14B	Tekenink loamy fine sand, 2 to 6 percent slopes
19	Gilford fine sandy loam (where drained)
22B	Perrinton loam, 2 to 6 percent slopes
23B	Ithaca loam, 0 to 4 percent slopes
24	Ziegenfuss loam (where drained)
26A	Metamora fine sandy loam, 0 to 3 percent slopes (where drained)
27	Corunna sandy loam (where drained)
29A	Minoa loamy fine sand, 0 to 3 percent slopes
30	Lamson fine sandy loam (where drained)
35B	Metea loamy sand, 1 to 6 percent slopes
39A	Londo loam, 0 to 3 percent slopes (where drained)
40	Parkhill loam (where drained)
45B	Guelph-Londo loams, 1 to 6 percent slopes (where drained)
49B	Marlette loam, 2 to 6 percent slopes
60B	Guelph loam, 2 to 6 percent slopes
61A	Selfridge sand, 0 to 3 percent slopes
65B	Arkport loamy fine sand, 1 to 6 percent slopes
67B	Remus sandy loam, 1 to 6 percent slopes
70B	Ithaca-Selfridge complex, 0 to 4 percent slopes
71	Cohoctah fine sandy loam, occasionally flooded (where drained)
74	Shoals silt loam (where drained)

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where wetness or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1980, according to the Michigan Agricultural Statistics *(4)* for the county, about 65,000 acres were planted to corn. Of this, about 9,500 acres were harvested for silage. About 18,000 acres were planted to wheat, about 6,400 acres were planted to oats, about 10,300 acres were planted to soybeans, and about 18,000 acres were planted to dry beans. A number of specialty crops were also produced in 1980. The most common specialty crops were mint, asparagus, snap beans, and celery. Small acreages of strawberries, blueberries, and apples were also harvested.

Food production in Isabella County could be increased by applying soil and water conservation practices and by extending the latest crop production technology to all the cropland in the county. This soil survey can help determine the conservation practices needed.

The soils and climate of the survey area are suited to some crops that are not commonly grown. Grain sorghum, potatoes, sunflowers, buckwheat, barley, and rye, for example, can be grown if economic conditions are favorable. Other specialty crops that could be grown commercially in the county are sweet corn, tomatoes, cucumbers, radishes, carrots, other vegetables, and small fruits.

Deep, well drained soils that warm early in the spring are suited to many vegetables and small fruits. The nearly level and undulating Arkport, Metea, Ormas, and Spinks soils on uplands are examples of such soils.

The mucky soils, if adequately drained and protected from soil blowing, are suited to a wide range of vegetables. Examples of mucky soils are the very poorly drained Pinnebog, Edwards, and Adrian soils.

Most of the well drained soils in the survey area are suited to orchard crops and nursery plants. Soils on low positions, where frost is frequent and air drainage is poor, however, are generally poorly suited to early vegetables, small fruits, and orchard crops.

The latest information and suggestions for growing crops can be obtained from the local offices of the Cooperative Extension Service and the Soil Conservation Service.

Most of the arable soils in the county respond well to nitrogen, phosphorus, and potassium fertilizers. Crops grown on organic soils may be deficient in micronutrients, such as zinc, boron, manganese, and copper, and generally respond to micronutrient fertilization. Many of the mineral soils may need periodic applications of ground limestone to raise their pH sufficiently for good growth of alfalfa and other crops that grow well only on slightly acid or neutral soils. On all soils, the amount of lime and fertilizer used should be based on the results of soil tests, on the need of the crop, and on the expected yield *(5)*. The Cooperative Extension Service can help to determine the amounts of fertilizer and lime to apply.

Organic matter is an important source of nitrogen for crops. It also promotes good soil tilth, reduces surface crusting, increases both available water capacity and water infiltration rate, and reduces water erosion. Increasing or maintaining organic matter content is a management concern on most of the well drained and somewhat poorly drained soils that are used as cropland. The organic matter content can be maintained or increased by using a crop rotation that includes grasses and legumes, returning crop residue to the soil, and regularly adding other organic matter.

Maintaining good soil tilth is a management concern on the somewhat poorly drained Ithaca, Londo, and Shoals soils and on the poorly drained Parkhill and Ziegenfuss soils. It is also a concern on the well drained Perrinton, Marlette, and Guelph soils. Working these soils when they are too wet results in soil compaction and the formation of clods. Additional tillage to break up the surface clods causes further compaction of the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields, which reduces organic matter content of the soil. Such compaction and loss of fertility increase the severity of surface crusting. Surface crusting hinders seedling emergence and increases runoff and erosion. Use of conservation tillage, which does not invert the soil and which leaves all or part of the crop residue on the surface, planting cover crops, and adding supplemental organic matter help to maintain good soil tilth.

Conserving soil moisture during dry periods is a management concern on the Algansee, Coloma, Covert, Gilford, Kingsville, Mecosta, Ormas, Pipestone, Plainfield, Spinks, Thetford, and Wasepi soils. Conservation tillage helps to conserve soil moisture by increasing organic matter content and thus available water capacity. Irrigation increases crop yields. The droughty soils and other soils in the county are suited to irrigation if proper conservation and management practices are followed. The soil features that affect the design, layout, construction, management, and performance of irrigation systems are identified in table 14.

Water erosion is a major hazard on the well drained cropland in the county. Water erosion reduces the soil's productive capacity by removing the surface layer, which contains most of the available plant nutrients and organic matter. In many areas, water erosion on farmland also results in the pollution of streams by sediment, nutrients, and pesticides. Controlling water erosion is a management concern on all of the soils that have slopes of 6 percent or more. It is also a concern on undulating areas of Arkport, Guelph, Londo, Marlette, Perrinton, Remus, Spinks, and Tekenink soils.

Erosion control practices provide a protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps a plant cover on the soil for an extended period reduces erosion and preserves the productivity of the soils. Using legume and grass forage crops in a cropping system reduces erosion on sloping land, provides nitrogen for other crops, and improves tilth. Conservation tillage also helps to control surface runoff and erosion. Cover crops, crop residue, and grassed waterways also help prevent erosion.

Soil blowing is a hazard on the sandy Algansee, Arkport, Belleville, Coloma, Covert, Kingsville, Mecosta, Metea, Minoa, Ormas, Pipestone, Plainfield, Selfridge, Spinks, Tekenink, Thetford, Wasepi, and Wixom soils and on the mucky Adrian, Edwards, and Pinnebog soils. Some of the loamy soils are also susceptible to soil blowing. Maintaining a plant cover, using surface mulch, planting vegetative barriers and field windbreaks, and roughening the surface by tillage minimize soil blowing on these soils. Conservation tillage also helps to prevent soil blowing.

Some soils are naturally too wet to be used as cropland and pasture unless they are artificially drained. These soils are the very poorly drained Adrian, Edwards, Pinnebog, and Gilford soils and the poorly drained Belleville, Cohoctah, Corunna, Kingsville, Lamson, Parkhill, and Ziegenfuss soils. The somewhat poorly drained Algansee, Ithaca, Londo, Metamora, Minoa, Pipestone, Selfridge, Shoals, Thetford, Wasepi, and Wixom soils also require artificial drainage for optimum crop yields.

The proper design of surface and subsurface drainage systems varies according to the kind of soil in which they are used. A combination of surface and subsurface drainage is needed in most areas of the somewhat poorly drained, poorly drained, and very poorly drained soils that are intensively row cropped. Finding adequate outlets for drainage systems is difficult in some areas.

Information on erosion control and drainage practices for each kind of soil can be obtained at the local office of the Soil Conservation Service.

Much of the permanent pasture in the county is on soils that are susceptible to erosion. Many other pastures are on wet soils. Control of erosion is particularly important during seeding operations. The need for lime and fertilizer should be determined by soil tests, and adequate amounts should be supplied.

Soil compaction, caused by grazing when the soils are wet, results in decreased growth of pasture. Using proper harvesting methods for such crops as hay and silage help to increase plant growth and reduce soil compaction.

The productivity of a pasture and its ability to protect the surface of the soil is influenced by the number of livestock it supports, the length of time they graze, and rainfall distribution. Good pasture management includes stocking at rates that maintain key forage species, pasture rotation, deferred grazing, grazing at the proper season, and supplying water at strategic locations for livestock.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops *(11)*. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability

units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed Soil Map Units."

In addition to capability classes and subclasses, each soil is assigned to a Michigan soil management group. This group, which is given at the end of the soil description, indicates the soil's need for lime and fertilizer and for artificial drainage and other practices. For soils making up a complex, the soil management groups are listed in the same order as the series named in the complex.

For a detailed explanation of the Michigan soil management groups see Michigan State University Extension Bulletin E-1262 *(6)*.

Woodland Management and Productivity

Virgin forest once covered almost all of the land in Isabella County, but most of the land suitable for cultivation has been cleared. In much of the woodland that remains, the soils are too wet or too steep for farming. These soils produce trees of high quality if the woodland is managed properly.

Woodland now makes up about 110,000 acres, or about 30 percent of the county. It is the dominant land use in associations 5, 9, 10, and 11 described in the section "General Soil Map Units." Woodlots are scattered throughout the other soil associations. On the upland soils, the most common trees are mixed hardwoods, mainly red oak, white oak, sugar maple, and white ash. On the mineral soils in low-lying areas and on bottom lands, the most common trees are red maple, basswood, silver maple, swamp white oak, black ash, and aspen; and on the very poorly drained organic soils the most common trees are white-cedar, silver maple, red maple, swamp white oak, and black ash.

Much of the existing woodland would benefit from thinning and other silvicultural practices, such as the control of disease, insects, and competition from undesirable plants. The Soil Conservation Service and the Michigan Department of Natural Resources, Division of Forestry, can help determine specific woodland management needs.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected

on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Recreation

Several lakes and approximately 2,700 acres of park and recreation land provide opportunities for recreation in Isabella County.

There are three campgrounds and two state recreation areas in the county. The Edmore State Game Area, an area of about 160 acres in the southwestern part of the county, is used mainly for hunting. The Chippewa River State Forest, in the east-central part of the county, has approximately 1,800 acres of land suitable for recreation. Seven county parks and five public and private golf courses are scattered throughout the county.

The development and use of recreation areas in the county have increased greatly in the past several years. Many of the soils in Isabella County are well suited to the development of recreation facilities.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Isabella County has a large and varied population of fish and wildlife. The wooded areas provide habitat for white-tailed deer, tree squirrel, raccoon, hawk, owl, and many types of songbirds. The farmed areas are habitat for ring-necked pheasant, rabbit, woodchuck, fox, and songbirds. The streams and lakes support bluegill, perch, smallmouth bass, largemouth bass, northern pike, and other species. Some of the lakes and wetland areas are used as nesting and feeding areas by waterfowl during the fall and spring migrations (fig. 14).

In many areas of the county, the wildlife habitat can be improved by increasing the food, cover, water, and living space that the wildlife need. Soils that are best suited to wildlife habitat are scattered throughout the county and are found in all of the soil associations described in the section, "General Soil Map Units." The Edmore State Game Area, most of which is in association 10, and the Chippewa River State Forest, which is in association 5, are important areas for wildlife habitat.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, water, and living space. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, rye, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are ragweed, goldenrod, lambsquarters, wild carrot, dandelions, burdocks, and wild strawberry.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are autumn-olive, crabapple, silky dogwood, gray dogwood, honeysuckle, and American cranberrybush.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are

Figure 14.—Wildlife and recreation pond in an area of poorly drained Kingsville soil.

texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cattail, rushes, sedges, reeds, and arrowhead.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include owls, ruffed grouse, woodcock, thrushes, woodpeckers, tree squirrels, red fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Each map unit is rated according to its potential for building site development and for septic tank absorption fields.

Soil potential ratings are classes that indicate the relative suitability for buildings with basements and septic tank absorption fields as compared with other soils in the county. Performance level, the relative cost of applying modern technology to minimize effects of any soil limitations, and the adverse effects of continuing limitations are considered *(13)*.

Soil potential rating classes are defined in terms of the performance expected of a soil if feasible measures are taken to overcome its limitations, the cost of such measures, and the magnitude of the limitations that remain after measures have been applied. Performance of each soil is compared with the established standard.

The soil potential rating classes used in Isabella County are:

High potential—Potential performance is likely to be at or above the level of the local standards; costs of

measures for overcoming soil limitations are judged locally to be favorable in relation to expected performance; and the soil limitations that remain after corrective measures are installed do not detract appreciably from environmental quality.

Medium potential—Potential performance is likely to be somewhat below the local standards; or costs of measures for overcoming soil limitations are high; or the soil limitations that remain after corrective measures are installed detract from environmental quality.

Low potential—Potential performance is likely to be significantly below the local standards; or measures required to overcome soil limitations are very costly; or the soil limitations that remain after corrective measures are installed detract appreciably from environmental quality.

Very low potential—Potential performance is likely to be far below the local standards; or there are severe soil limitations for which no economically feasible measures are available; or the soil limitations that remain after corrective measures are installed seriously detract from environmental quality.

The potential ratings were made with assistance from the Central Michigan District Health Department, the Michigan Department of Agriculture, and local contractors. The worksheets and a list of criteria used to develop the ratings are available in the local office of the Soil Conservation Service.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use

and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent. Large stones interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, and rock fragments.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. The content of large stones affects the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones. The performance of a system is affected by the depth of the root zone and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, and large stones affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, and slope affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

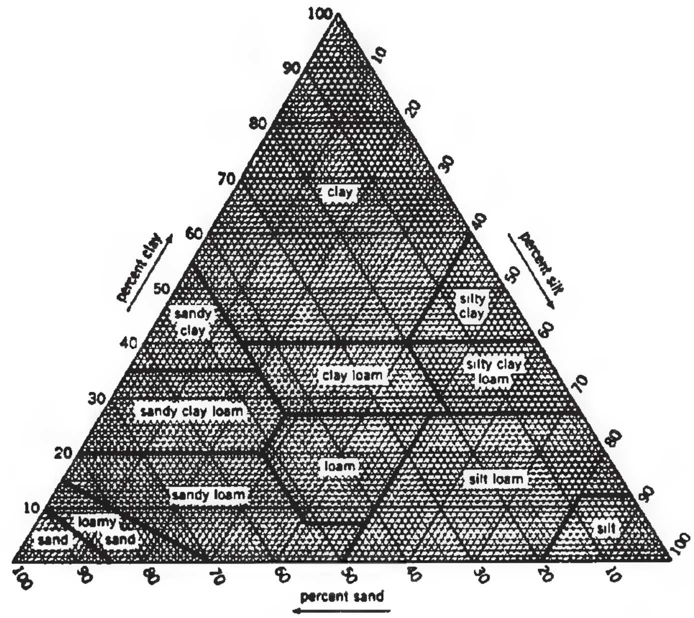

Figure 15. Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 15). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one

of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The

change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission. Some soils are assigned to two hydrologic soil groups because part of the acreage is drained and part is not drained.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from

adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 17 shows total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Soil Characterization Data for Selected Soils

Many of the soils in Isabella County were sampled, and laboratory data were determined by the Soil Research Laboratory, Ford Forestry Center, Michigan Technological University, L'Anse, Michigan *(8)*. The laboratory data obtained from the soil samples include particle size distribution analysis, coarse fragments analysis, bulk density, and moisture retention data.

Complete chemical analyses were also performed on each sample, and spodic horizon criteria were determined on the appropriate samples. Standard National Cooperative Soil Survey procedures were used for all analyses. In addition to soil samples, forest sites were sampled to estimate forest productivity on many of the sampled soils.

The data were used in the classification and correlation of these soils and in evaluating their behavior, especially under forestry uses. Eight profiles were selected as representative for the respective series. These series and their laboratory identification numbers are: Coloma (S80MI073-3), Covert (S80MI073-6), Houghton (S80MI073-5), Kingsville (S80MI073-8), Pipestone (S80MI073-7), Plainfield (S80MI073-4), Remus (S80MI073-1), and Spinks (S80MI073-2). The field morphology and laboratory data for these soils are published as a separate investigations report (Padley and Trettin, 1983).

In addition to the Isabella County data, soil characterization data and forest site data are available from nearby counties that have many of the same soils that were not sampled in Isabella County. These data and the Isabella County data are available from the Soil Research Laboratory, Ford Forestry Center, Michigan Technological University, L'Anse, Michigan; the Soil and Water Conservation Division, Michigan Department of Agriculture, Lansing, Michigan; and the Soil Conservation Service, State Office, East Lansing, Michigan.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(12)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (10)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (12)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Adrian Series

The Adrian series consists of deep, very poorly drained, organic soils in bogs and other depressional areas on outwash plains and moraines. These soils formed in decomposed herbaceous materials over sandy mineral deposits. Permeability is moderately slow to moderately rapid in the organic material and rapid in the sandy substratum. The slope ranges from 0 to 2 percent.

The Adrian soils are similar to Edwards soils and are commonly adjacent to Pinnebog, Thetford, and Spinks soils. The Edwards soils have organic material to a depth of 16 to 51 inches and, below that, marl. The

Pinnebog soils have organic material to a depth of more than 51 inches. The Thetford soils are somewhat poorly drained, and the Spinks soils are well drained. The Pinnebog soils and the Adrian soils are in similar positions on the landscape. The Thetford and Spinks soils are higher on the landscape than the Adrian soils.

Typical pedon of Adrian muck, 150 feet east and 1,220 feet south of the northwest corner of sec. 33, T. 13 N., R. 4 W., Lincoln Township:

Oa1—0 to 11 inches; black (5YR 2.5/1) broken face and rubbed sapric material; less than 5 percent fiber unrubbed, less than 1 percent rubbed; moderate fine granular structure; very friable; primarily herbaceous fibers; less than 5 percent mineral material; neutral; abrupt wavy boundary.

Oa2—11 to 22 inches; black (5YR 2.5/1) broken face and rubbed sapric material; less than 5 percent fiber unrubbed, less than 1 percent rubbed; strong coarse subangular blocky structure; friable; primarily herbaceous fibers; less than 5 percent mineral material; neutral; abrupt wavy boundary.

Oa3—22 to 26 inches; black (10YR 2/1) broken face and rubbed sapric material; few fine prominent strong brown (7.5YR 5/8) mottles; less than 5 percent fiber unrubbed, less than 1 percent rubbed; moderate fine platy structure; friable; primarily herbaceous fibers; less than 5 percent mineral material; neutral; abrupt wavy boundary.

Cg1—26 to 36 inches; dark gray (10YR 4/1) sand; single grained; loose; 5 percent pebbles; violent effervescence; mildly alkaline; clear wavy boundary.

Cg2—36 to 46 inches; gray (10YR 5/1) sand; single grained; loose; 10 percent pebbles; violent effervescence; mildly alkaline; abrupt wavy boundary.

Cg3—46 to 52 inches; stratified grayish brown (2.5Y 5/2) very fine sand and silt; massive; firm; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cg4—52 to 60 inches; gray (10YR 5/1) gravelly sand; single grained; loose; 30 percent pebbles; violent effervescence; moderately alkaline.

The depth to the C horizon ranges from 16 to 50 inches. The organic material is primarily herbaceous, but in many pedons, woody fragments are mixed throughout the organic layers. The organic material has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 0 to 3. Reaction ranges from strongly acid to mildly alkaline.

The surface tier is typically sapric material, but the range includes hemic material.

The subsurface tier and bottom tiers are predominantly sapric material, but in some pedons, up to 10 inches of hemic material is in these tiers. Some pedons have up to 2 inches of limnic material above the C horizon.

The C horizon ranges from slightly acid to moderately alkaline. Pebble content ranges from 0 to 50 percent.

Algansee Series

The Algansee series consists of deep, somewhat poorly drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvium. The slope ranges from 0 to 2 percent.

The Algansee soils are commonly adjacent to Cohoctah, Selfridge, and Spinks soils. The Cohoctah soils are poorly drained and are lower on the landscape than the Algansee soils. The Selfridge soils have more clay in the subsoil and substratum and, unlike Algansee soils, are not subject to flooding. The Selfridge soils are higher on the landscape than the Algansee soils. The Spinks soils are well drained and are higher on the landscape than the Algansee soils.

Typical pedon of Algansee loamy sand, 1,540 feet south and 660 feet west of the northeast corner of sec. 25, T. 14 N., R. 5 W., Deerfield Township:

A—0 to 8 inches; very dark gray (10YR 3/1) loamy sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; neutral; abrupt wavy boundary.

C1—8 to 14 inches; dark brown (10YR 4/3) sand; many medium faint dark yellowish brown (10YR 4/4) and few medium distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; very friable; neutral; clear wavy boundary.

C2—14 to 19 inches; dark yellowish brown (10YR 4/6) sand; few fine distinct brown (10YR 5/3) and few coarse faint dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; very friable; neutral; clear wavy boundary.

C3—19 to 25 inches; strong brown (10YR 5/6) sand; few coarse prominent grayish brown (10YR 5/2) and few medium faint dark yellowish brown (10YR 4/6) mottles; single grained; loose; neutral; clear wavy boundary.

C4—25 to 41 inches; yellowish brown (10YR 5/4) sand; common medium distinct grayish brown (10YR 5/2) and few fine distinct dark brown (7.5YR 4/4) mottles; single grained; loose; neutral; clear wavy boundary.

C5—41 to 55 inches; light brownish gray (10YR 6/2) sand; few coarse prominent yellowish brown (10YR 5/6) mottles and few fine prominent dark brown (10YR 4/3) organic stains; single grained; loose; neutral; clear wavy boundary.

C6—55 to 60 inches; grayish brown (10YR 5/2) sand; common medium prominent dark yellowish brown (10YR 4/6) mottles; single grained; loose; discontinuous, 1- to 2-inch thick layer of black (10YR 2/1) sapric material; neutral.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loamy sand, but the range includes sand, sandy loam, and very fine sandy loam. Reaction in the A horizon is slightly acid or neutral.

The C horizon has hue of 7.5YR or 10YR. It is dominantly sand, but the range includes loamy sand. Some pedons also contain thin strata of sandy loam, loam, silt loam, or gravel. Reaction in the C horizon ranges from neutral to moderately alkaline.

Arkport Series

The Arkport series consists of deep, well drained, moderately rapidly permeable soils on outwash plains. These soils formed in sandy and loamy glaciofluvial material. The slope ranges from 1 to 12 percent.

The Arkport soils are commonly adjacent to Marlette and Remus soils. The Marlette and Remus soils have more clay throughout the solum. They and the Arkport soils are in similar positions on the landscape.

Typical pedon of Arkport loamy fine sand, 1 to 6 percent slopes, 530 feet south and 200 feet east of the northwest corner of sec. 29, T. 16 N., R. 3 W., Wise Township:

Ap—0 to 7 inches; dark brown (10YR 3/3) loamy fine sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

E—7 to 11 inches; yellowish brown (10YR 5/4) loamy fine sand, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure parting to weak fine granular structure; friable; neutral; clear wavy boundary.

E&Bt—11 to 16 inches; pale brown (10YR 6/3) loamy fine sand, light gray (10YR 7/2) dry (E) and dark yellowish brown (10YR 4/4) fine sandy loam (Bt); moderate medium subangular blocky structure parting to weak fine granular structure; friable; neutral; gradual wavy boundary.

(Bt&E)1—16 to 23 inches; dark brown (7.5YR 3/4) loam (Bt) and brown (10YR 5/3) loamy fine sand, light gray (10YR 5/2) dry (E); moderate medium subangular blocky structure; friable; neutral; clear wavy boundary.

(Bt&E)2—23 to 41 inches; yellowish brown (10YR 5/6) loamy very fine sand lamellae 1 inch to 4 inches thick; weak fine subangular blocky structure; very friable (Bt); light yellowish brown (10YR 6/4) fine sand (E); single grained; loose; neutral; clear wavy boundary.

(E&Bt)1—41 to 57 inches; light yellowish brown (10YR 6/4) loamy very fine sand, very pale brown (10YR 7/4) dry; single grained; loose (E); discontinuous, 1/8- to 1/2-inch thick, light yellowish brown (10YR 6/4) very fine sandy loam lamellae (Bt); weak fine granular structure; friable; neutral; clear wavy boundary.

C—57 to 60 inches; light yellowish brown (10YR 6/4) fine sand; single grained; loose; neutral.

The thickness of the solum and the depth to free carbonates range from a depth of 36 to 60 inches. Pebble content ranges from 0 to 5 percent in the pedon. Reaction in the solum ranges from very strongly acid to neutral.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. The E horizon has value of 4 to 6 and chroma of 3 or 4. The A and E horizons are dominantly loamy fine sand, but the range includes loamy sand, sandy loam, loamy very fine sand, and fine sand.

The E part of the E&Bt and Bt&E horizons has color and texture like those of the E horizon. The Bt part of the E&Bt and Bt&E has value of 3 to 6 and chroma of 3 or 4. The lamellae are sandy loam, fine sandy loam, very fine sandy loam, loamy very fine sand, or loam. The individual lamellae range from 1/8 inch to 4 inches in thickness. Depth to the first lamellae is less than 15 inches.

The C horizon has value of 4 to 6 and chroma of 2 to 4. It is fine sand, very fine sand, fine sandy loam, or silt loam. Reaction in the C horizon ranges from medium acid through moderately alkaline.

Belleville Series

The Belleville series consists of deep, poorly drained soils in drains and depressions on glaciated uplands. These soils formed in sandy glaciofluvial deposits over loamy glacial drift. Permeability is rapid in the upper part and moderately slow in the lower part. The slope is 0 to 2 percent.

The Belleville soils are similar to Corunna soils and are commonly adjacent to Selfridge, Pipestone, and Kingsville soils. The Corunna soils have more clay in the solum. The Selfridge soils and the Pipestone soils are somewhat poorly drained and are slightly higher on the landscape than the Belleville soils. The Kingsville soils are sandy throughout the solum and substratum. They and the Belleville soils are in similar positions on the landscape.

Typical pedon of Belleville loamy sand, 1,305 feet east and 2,615 feet north of the southwest corner of sec. 23, T. 13 N., R. 3 W., Coe Township:

Ap—0 to 12 inches; very dark grayish brown (10YR 3/2) loamy sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; 1 percent pebbles; neutral; abrupt smooth boundary.

Bg1—12 to 17 inches; grayish brown (10YR 5/2) sand; common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) and many medium faint brown (10YR 5/3) mottles; single grained; loose; common fine and medium black (N

2/0) iron-manganese concretions; 3 percent pebbles; neutral; clear wavy boundary.

Bg2—17 to 23 inches; grayish brown (10YR 5/2) sand; many medium prominent yellowish brown (10YR 5/6) and many medium distinct yellowish brown (10YR 5/4) and common medium faint dark grayish brown (10YR 4/2) mottles; single grained; loose; common fine and medium black (N 2/0) iron-manganese concretions; 3 percent pebbles; slightly acid; abrupt irregular boundary.

Bg3—23 to 33 inches; grayish brown (10YR 5/2) sand; few medium prominent yellowish brown (10YR 5/6) mottles; single grained; loose; 2 percent pebbles; neutral; abrupt wavy boundary.

2Cg—33 to 60 inches; gray (10YR 5/1) loam; many coarse distinct dark gray (N 4/0) mottles; massive; firm; 1 percent pebbles; strong effervescence; moderately alkaline.

The depth to the 2C horizon ranges from 20 to 40 inches. The mollic epipedon is 11 to 16 inches thick. Pebble content ranges from 0 to 5 percent in the pedon. Reaction in the solum ranges from slightly acid to moderately alkaline.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loamy sand, but the range includes fine sand, sand, or loamy fine sand.

The Bg horizon has value of 4 to 6 and chroma of 1 or 2. It is sand, fine sand, loamy sand, or loamy fine sand.

In some pedons the C horizon is sand, fine sand, loamy sand, or loamy fine sand. Reaction in the C horizon is mildly or moderately alkaline.

The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 6. It is loam, clay loam, or silty clay loam.

Cohoctah Series

The Cohoctah series consists of deep, poorly drained soils on flood plains. These soils formed in loamy and sandy alluvium. Permeability is moderately rapid in the upper part and rapid in the lower part. The slope ranges from 0 to 2 percent.

The Cohoctah soils are similar to Gilford soils and are commonly adjacent to Algansee and Shoals soils. The Gilford soils are very poorly drained and, unlike Cohoctah soils, are not subject to flooding. The Algansee and Shoals soils are somewhat poorly drained and are slightly higher on the landscape than the Cohoctah soils.

Typical pedon of Cohoctah fine sandy loam, frequently flooded, 800 feet west and 400 feet south of the northeast corner of sec. 21, T. 14 N., R. 4 W., Union Township:

A1—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; neutral; clear wavy boundary.

A2—10 to 13 inches; dark grayish brown (10YR 4/2) fine sandy loam, dark gray (10YR 4/1) dry; common fine prominent yellowish brown (10YR 5/6) mottles and few fine faint very dark grayish brown (10YR 3/2) organic stains; weak fine and medium subangular blocky structure parting to weak fine granular; friable; neutral; abrupt wavy boundary.

C1—13 to 21 inches; pale brown (10YR 6/3) loamy fine sand; common medium prominent strong brown (7.5YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; very friable; neutral; clear wavy boundary.

C2—21 to 35 inches; dark brown (10YR 4/3) fine sandy loam; many coarse prominent dark red (2.5YR 3/6) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; neutral; abrupt irregular boundary.

C3—35 to 51 inches; brown (10YR 5/3) sand; common fine prominent strong brown (7.5YR 5/6) mottles; single grained; loose; mildly alkaline; abrupt irregular boundary.

C4—51 to 60 inches; dark grayish brown (2.5Y 4/2) sand; common medium black (N 2/0) organic stains; single grained; loose; strong effervescence; mildly alkaline.

The mollic epipedon is 10 to 18 inches thick. Pebble content ranges from 0 to 5 percent in the A horizon and the upper part of the C horizon and from 0 to 50 percent in the lower part of the C horizon. Reaction in the upper 20 inches ranges from slightly acid to mildly alkaline. Below a depth of 20 inches, it ranges from neutral to moderately alkaline.

The A horizon has value of 2 to 4 and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes sandy loam, loamy fine sand, and loam.

The C1 and C2 horizons have hue of 10YR, 7.5YR, or 2.5Y; value of 3 to 6; and chroma of 1 to 3. Texture is fine sandy loam, loamy fine sand, sandy loam, or loam.

The C3 and C4 horizons have hue of 10YR, 7.5YR, or 2.5Y; value of 3 to 6; and chroma of 1 to 3. Texture is sand, loamy sand, or gravelly sand.

Coloma Series

The Coloma series consists of deep, somewhat excessively drained, rapidly permeable soils in drains and depressions on glaciated uplands. These soils formed in sandy glaciofluvial deposits or sandy glacial till. The slope ranges from 0 to 45 percent.

The Coloma soils are similar to Spinks and Plainfield soils and are commonly adjacent to Selfridge and Ormas soils. The Selfridge soils are somewhat poorly drained and are lower on the landscape than the Coloma soils. The Spinks and Ormas soils have more clay in the

subsoil, and the Plainfield soils have less clay in the subsoil than the Coloma soils. The Ormas soils and the Coloma soils are in similar positions on the landscape.

Typical pedon of Coloma sand, 0 to 6 percent slopes, 1,310 feet east and 390 feet south of the northwest corner of sec. 18, T. 13 N., R. 4 W., Lincoln Township:

Ap—0 to 11 inches; dark brown (10YR 3/3) sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; 1 percent pebbles; medium acid; abrupt smooth boundary.

E—11 to 41 inches; yellowish brown (10YR 5/6) sand, brownish yellow (10YR 6/8) dry; single grained; loose; 1 percent pebbles; slightly acid; abrupt wavy boundary.

E&Bt—41 to 60 inches; light yellowish brown (10YR 5/6) sand, brownish yellow (10YR 6/8) dry (E); single grained; loose; discontinuous, 1/8- to 1/4-inch thick, strong brown (7.5YR 4/6) loamy sand lamellae (Bt); weak fine subangular blocky structure; very friable; 1 percent pebbles; clay bridging between sand grains; strongly acid.

Pebble content ranges from 0 to 10 percent in the solum. Reaction in the solum ranges from strongly acid to neutral.

The Ap horizon has color value of 2 or 3 and chroma of 1 to 3. In uncultivated areas, the A horizon is 1 to 5 inches thick. It is dominantly sand, but the range includes loamy sand and loamy fine sand. The E horizon has value of 4 to 6 and chroma of 4 to 6. It is sand or loamy sand.

The E part of the E&Bt horizon has color and texture like those of the E horizon. The Bt part of the E&Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The lamellae are dominantly loamy sand, but the range includes sandy loam. The individual lamellae range from 1/16 to 1 inch in thickness. Depth to the first lamellae ranges from 40 to 60 inches.

Corunna Series

The Corunna series consists of deep, poorly drained soils in drains and depressions on glaciated uplands. These soils formed in loamy glaciofluvial deposits over silty glacial till. Permeability is moderate or moderately rapid in the solum and moderately slow in the substratum. The slope ranges from 0 to 2 percent.

The Corunna soils are similar to Gilford, Lamson, and Parkhill soils and are commonly adjacent to Londo, Parkhill, and Selfridge soils. The Gilford and Lamson soils have less clay in the substratum, and the Parkhill soils have more clay in the solum than Corunna soils. The Londo and Selfridge soils are somewhat poorly drained and are slightly higher on the landscape than the Corunna soils.

Typical pedon of Corunna sandy loam, 200 feet north and 630 feet west of the southeast corner of sec. 13, T. 14 N., R. 4 W., Union Township:

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

Bg1—11 to 26 inches; grayish brown (2.5Y 5/2) sandy loam; few fine prominent light olive brown (2.5Y 5/6) and common medium distinct dark grayish brown (10YR 4/2) mottles; weak fine subangular blocky structure; very friable; neutral; clear wavy boundary.

Bg2—26 to 33 inches; grayish brown (10YR 5/2) sandy loam; few fine prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; very friable; neutral; abrupt wavy boundary.

2C1—33 to 40 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct gray (10YR 5/1) and few fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; mildly alkaline; clear wavy boundary.

2C2—40 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam; many medium prominent yellowish brown (10YR 5/6) and few fine prominent light olive brown (2.5Y 5/6) mottles; massive; firm; strong effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. Depth to the 2C horizon ranges from 26 to 40 inches. Pebble content in the solum ranges from 0 to 10 percent, and reaction ranges from slightly acid to mildly alkaline. The mollic epipedon is 10 to 12 inches thick.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly sandy loam, but the range includes fine sandy loam and loam.

The Bg horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 or 6; and chroma of 1 to 4. It is sandy loam, fine sandy loam, loam, or loamy fine sand.

In some pedons, a gravelly sandy loam, sandy loam, or loamy fine sand C horizon is above the 2C horizon.

The 2C horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 to 6. It is loam, clay loam, or silty clay loam. Reaction in the 2C horizon is mildly alkaline or moderately alkaline.

Covert Series

The Covert series consists of deep, moderately well drained, rapidly permeable soils on beach ridges, glacial deltas, outwash plains, glacial drainageways, till plains, and moraines. These soils formed in sandy glaciofluvial deposits. The slope ranges from 0 to 4 percent.

The Covert soils are similar to Pipestone soils and are commonly adjacent to Pipestone and Kingsville soils. The Pipestone soils are somewhat poorly drained. The

Kingsville soils are poorly drained and are lower on the landscape than the Covert soils.

Typical pedon of Covert sand, 0 to 4 percent slopes, 790 feet east and 460 feet north of the southwest corner of sec. 14, T. 14 N., R. 3 W., Chippewa Township:

A—0 to 5 inches; black (10YR 2/1) sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many fine roots; medium acid; abrupt wavy boundary.

E—5 to 10 inches; brown (7.5YR 5/2) sand, pinkish gray (7.5YR 6/2) dry; single grained; loose; common roots; medium acid; clear wavy boundary.

Bhs—10 to 19 inches; dark reddish brown (5YR 3/4) sand; single grained; loose; medium acid; gradual wavy boundary.

Bs1—19 to 28 inches; strong brown (7.5YR 4/6) sand; single grained; loose; medium acid; gradual wavy boundary.

Bs2—28 to 35 inches; strong brown (7.5YR 5/6) sand; single grained; loose; medium acid; gradual wavy boundary.

C—35 to 60 inches; brownish yellow (10YR 6/6) sand; few fine distinct light yellowish brown (10YR 6/4) mottles; single grained; loose; medium acid.

The solum is 24 to 40 inches thick. Pebble content ranges from 0 to 5 percent throughout the pedon. Reaction in the solum ranges from very strongly acid to neutral.

The A horizon has hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 or 2. It is dominantly sand, but the range includes loamy sand. The E horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 1 to 3. It is loamy sand or sand.

The Bs horizons have hue of 10YR, 7.5YR, or 5YR; value of 3 to 6; and chroma of 3 to 6. Some pedons have from 0 to 30 percent ortstein within the Bs horizon. Some pedons have a BC horizon.

The C horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 to 7; and chroma of 1 to 8. It is sand or fine sand. Reaction in the C horizon ranges from medium acid to moderately alkaline.

Edwards Series

The Edwards series consists of deep, very poorly drained, moderately slowly to moderately rapidly permeable organic soils in bogs and other depressional areas. These soils, which are on outwash plains, till plains, and moraines, formed in decomposed herbaceous materials over marl deposits. The slope ranges from 0 to 2 percent.

The Edwards soils are similar to Adrian soils and are commonly adjacent to Perrinton and Pinnebog soils. The Adrian soils have 16 to 51 inches of organic material over sand or sand and gravel. The Pinnebog soils have more than 51 inches of organic material. They and the Edwards soils are in similar positions on the landscape. The Perrinton soils are well drained and are higher on the landscape than the Edwards soils.

Typical pedon of Edwards muck, 270 feet north and 1,320 feet east of the southwest corner of sec. 24, T. 13 N., R. 4 W., Lincoln Township:

Oa1—0 to 9 inches; black (N 2/0) broken face and rubbed sapric material; about 15 percent fiber unrubbed, less than 10 percent rubbed; moderate medium granular structure; friable; primarily herbaceous fibers; slightly acid; abrupt smooth boundary.

Oa2—9 to 16 inches; black (10YR 2/1) broken face, very dark brown (10YR 2/2) rubbed sapric material; about 15 percent fiber unrubbed, about 5 percent rubbed; moderate coarse subangular blocky structure; friable; primarily herbaceous fibers; neutral; clear smooth boundary.

Oa3—16 to 20 inches; black (10YR 2/1) broken face, very dark brown (10YR 2/2) rubbed sapric material; about 5 percent fiber unrubbed, less than 5 percent rubbed; moderate coarse platy structure; friable; primarily herbaceous fibers; neutral; abrupt smooth boundary.

Oa4—20 to 24 inches; very dark grayish brown (10YR 3/2) broken face and rubbed sapric material; about 5 percent fiber unrubbed, less than 5 percent rubbed; massive; friable; primarily herbaceous fibers, many light gray (10YR 7/2) shells and shell fragments; violent effervescence; mildly alkaline; abrupt smooth boundary.

C—24 to 60 inches; light brownish gray (10YR 6/2) marl; few fine prominent yellowish brown (10YR 5/6) mottles; massive; friable; common light gray (10YR 7/2) shells and shell fragments; violent effervescence; moderately alkaline.

The depth to the C horizon ranges from 16 to 50 inches. The organic material is primarily herbaceous, but in many pedons, woody fragments are mixed throughout the organic layers. Reaction in the organic material ranges from medium acid to mildly alkaline.

The surface tier has chroma of 0 to 2.

The subsurface and bottom tiers have hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 0 to 3. Thin layers of hemic material less than 10 inches thick are in some pedons.

The C horizon has hue of 10YR or 2.5Y, value of 5 to 8, and chroma of 1 or 2. Reaction in the C horizon is neutral to moderately alkaline. In some pedons, the marl is underlain by mineral deposits at a depth of 40 to 60 inches.

Gilford Series

The Gilford series consists of deep, very poorly drained soils in depressions and drainageways on glaciated uplands. These soils formed in loamy glaciofluvial deposits over sandy and gravelly deposits. Permeability is moderately rapid in the solum and very rapid in the substratum. The slope ranges from 0 to 2 percent.

The Gilford soils are similar to Cohoctah and Corunna soils and are commonly adjacent to Wasepi, Londo, and Parkhill soils. Unlike Gilford soils, the Cohoctah soils are subject to flooding. The Corunna soils have more clay in the substratum than Gilford soils. The Parkhill soils have more clay in the subsoil and substratum. They and the Gilford soils are in similar positions on the landscape. The Londo and Wasepi soils are somewhat poorly drained and are slightly higher on the landscape than the Gilford soils.

Typical pedon of Gilford fine sandy loam, 760 feet east and 210 feet north of the center of sec. 26, T. 13 N., R. 4 W., Lincoln Township:

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam; dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; clear wavy boundary.

A—11 to 14 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; abrupt wavy boundary.

Bg—14 to 24 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) gravelly sandy loam; common medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak fine subangular blocky structure; friable; 20 percent pebbles; neutral; abrupt broken boundary.

2C1—24 to 29 inches; brown (10YR 4/3) sand; common medium faint dark grayish brown (10YR 4/2) and many medium prominent yellowish red (5YR 4/6) mottles; single grained; loose; 3 percent pebbles; strong effervescence; mildly alkaline; abrupt irregular boundary.

2C2—29 to 48 inches; brown (10YR 4/3) extremely gravelly sand; single grained; loose; about 75 percent pebbles; strong effervescence; mildly alkaline; abrupt irregular boundary.

2C3—48 to 60 inches; dark grayish brown (10YR 4/2) extremely gravelly sand; single grained; loose; 75 percent pebbles; violent effervescence; moderately alkaline.

The thickness of the solum and the depth to the 2C horizon range from 20 to 44 inches. Pebble content is 0 to 20 percent in the solum and 20 to 75 percent in the 2C horizon. Reaction in the solum is slightly acid or neutral. The mollic epipedon is 10 to 15 inches thick.

The Ap horizon has value of 2 or 3 and chroma of 1 to 3. It is dominantly fine sandy loam, but the range includes sandy loam, loam, or loamy sand.

The Bg horizon has value of 4 to 6 and chroma of 1 or 2. It is gravelly sandy loam, gravelly loamy sand, or sandy loam.

The 2C horizon has value of 4 to 6 and chroma of 1 to 3. Texture ranges from gravelly sand to extremely gravelly sand. Reaction ranges from neutral to moderately alkaline.

Guelph Series

The Guelph series consists of deep, well drained, moderately permeable soils on moraines and till plains. These soils formed in loamy glacial till. The slope ranges from 1 to 12 percent.

The Guelph soils are similar to Marlette and Perrinton soils and are commonly adjacent to Londo and Parkhill soils. The Marlette soils have a thicker solum than Guelph soils, and the Perrinton soils have a finer textured subsoil. The Londo soils are somewhat poorly drained, and the Parkhill soils are poorly drained. The Londo and Parkhill soils are lower on the landscape than the Guelph soils.

Typical pedon of Guelph loam, 6 to 12 percent slopes, 140 feet east and 1,020 feet north of the southwest corner of sec. 27, T. 14 N., R. 4 W., Union Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; 2 percent pebbles; neutral; abrupt smooth boundary.

B/E—9 to 13 inches; dark yellowish brown (10YR 4/4) clay loam (Bt) with brown (10YR 5/3) sandy loam, light gray (10YR 7/2) dry (E) coatings on surfaces of peds and along root channels; moderate fine subangular blocky structure; friable; 2 percent pebbles; neutral; clear irregular boundary.

Bt—13 to 25 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine and medium subangular blocky structure; firm; 2 percent pebbles; many thin dark brown (10YR 3/3 and 7.5YR 3/2) clay films on surfaces of peds and in root channels; neutral; abrupt irregular boundary.

C—25 to 60 inches; yellowish brown (10YR 5/4) loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; 2 percent pebbles; few thin streaks of white (10YR 8/2) secondary lime; violent effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 12 to 25 inches. The solum is slightly acid or neutral. Pebble content ranges from 2 to 10 percent throughout the pedon.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loam, but the range includes sandy

loam. The E portion of the B/E horizon has value of 5 or 6 and chroma of 2 or 3. It is loam or sandy loam. Some pedons have a separate E horizon.

The Bt horizon and B part of the B/E horizon have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam or clay loam.

The C horizon has a value of 4 to 6 and chroma of 3 or 4. It is loam or clay loam. Reaction in the C horizon is mildly alkaline or moderately alkaline.

Ithaca Series

The Ithaca series consists of deep, somewhat poorly drained, moderately slowly permeable soils on till plains and moraines. These soils formed in loamy glacial till. The slope ranges from 0 to 4 percent.

The Ithaca soils are similar to Londo soils and are commonly adjacent to Ziegenfuss and Perrinton soils. The Londo soils have less clay in the solum and substratum. The Ziegenfuss soils are poorly drained, and the Perrinton soils are well drained. The Ziegenfuss soils are lower on the landscape, and the Perrinton soils are higher on the landscape than the Ithaca soils.

Typical pedon of Ithaca loam, 0 to 4 percent slopes, 360 feet north and 850 feet east of the southwest corner of sec. 22, T. 15 N., R. 5 W., Nottawa Township:

Ap—0 to 10 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to weak fine granular; friable; about 2 percent pebbles; slightly acid; abrupt smooth boundary.

B/E—10 to 14 inches; dark brown (7.5YR 4/4) clay loam (Bt) with brown (10YR 5/3) loam, pale brown (10YR 5/3) dry (E) coatings on surfaces of peds and along root and worm channels; few fine distinct grayish brown (10YR 5/2) and common fine prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; 2 percent pebbles; slightly acid; abrupt irregular boundary.

Bt—14 to 30 inches; dark brown (10YR 4/3) clay loam; few fine faint grayish brown (10YR 5/2) and few fine distinct dark yellowish brown (10YR 4/6) mottles; moderate fine and medium subangular blocky structure; firm; 2 percent pebbles; many thin dark grayish brown (10YR 4/2) clay films on surfaces of peds and in root channels; neutral; abrupt wavy boundary.

C—30 to 60 inches; brown (7.5YR 5/4) clay loam; few fine distinct brown (7.5YR 5/2) and strong brown (7.5YR 5/6) mottles; massive; firm; 2 percent pebbles; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 20 to 40 inches. Pebble content ranges from 2 to 10 percent throughout the pedon. The solum ranges from medium acid to mildly alkaline.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loam, but the range includes sandy loam. Some pedons have an E horizon of sandy loam. The E portion of the B/E horizon has value of 4 to 6 and chroma of 2 to 4. It is loam or sandy loam.

The Bt horizon and the Bt portion of the B/E horizon have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. Reaction is mildly alkaline or moderately alkaline.

Kingsville Series

The Kingsville series consists of deep, poorly drained, rapidly permeable soils in drains and depressions on glaciated uplands. These soils formed in sandy glaciofluvial deposits. The slope is 0 to 2 percent.

The Kingsville soils are commonly adjacent to Pipestone and Covert soils. The Pipestone soils are somewhat poorly drained, and the Covert soils are moderately well drained. The Pipestone and Covert soils are higher on the landscape than the Kingsville soils.

Typical pedon of Kingsville loamy sand, 125 feet east and 1,320 feet north of the southwest corner of sec. 24, T. 14 N., R. 3 W., Chippewa Township:

A—0 to 8 inches; black (10YR 2/1) loamy sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; strongly acid; abrupt wavy boundary.

Bg1—8 to 20 inches; dark grayish brown (10YR 4/2) sand; many fine faint grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/4) mottles; single grained; loose; medium acid; clear wavy boundary.

Bg2—20 to 30 inches; grayish brown (10YR 5/2) sand; few medium faint dark gray (10YR 4/1) and many medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; slightly acid; clear wavy boundary.

Bg3—30 to 40 inches; dark grayish brown (10YR 4/2) sand; few medium distinct yellowish brown (10YR 5/4) mottles; single grained; loose; slightly acid; abrupt wavy boundary.

Cg—40 to 60 inches; dark grayish brown (10YR 4/2) sand; single grained; loose; neutral.

The solum is 24 to 40 inches thick. Pebble content ranges from 0 to 10 percent in the solum. The solum ranges from strongly acid to slightly acid.

The Ap horizon has value of 2 or 3 and a chroma of 1 or 2. It is dominantly loamy sand, but the range includes loamy fine sand. Some pedons have an E horizon.

The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 0 to 2. It is sand, fine sand, or loamy fine sand.

The Cg horizon has value of 4 or 6 and chroma of 1 or 2. It is sand, fine sand, or loamy fine sand. Reaction ranges from medium acid to neutral.

Lamson Series

The Lamson series consists of deep, poorly drained, moderately or moderately rapidly permeable soils in drains and depressions on glaciated uplands. These soils formed in stratified loamy and sandy glaciofluvial sediments. The slope is 0 to 2 percent.

The Lamson soils in this survey area are a taxadjunct to the Lamson series because they have a thicker dark colored surface layer than is definitive for the Lamson series. This difference does not alter the usefulness or behavior of the soils.

The Lamson soils are similar to Corunna soils and are commonly adjacent to Thetford and Gilford soils. The Corunna soils have more clay throughout the solum and substratum. The Gilford soils are very poorly drained. They and the Lamson soils are in similar positions on the landscape. The Thetford soils are somewhat poorly drained and are slightly higher on the landscape than the Lamson soils.

Typical pedon of Lamson fine sandy loam, 300 feet south and 100 feet east of the northwest corner of sec. 31, T. 13 N., R. 4 W., Lincoln Township:

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure parting to moderate fine granular; very friable; 1 percent pebbles; neutral; abrupt smooth boundary.

Bg1—11 to 19 inches; dark grayish brown (2.5Y 4/2) fine sandy loam; common fine prominent light olive brown (2.5Y 5/6 and 2.5Y 5/4) mottles; weak medium subangular blocky structure; friable; 1 percent pebbles; neutral; gradual wavy boundary.

Bg2—19 to 24 inches; grayish brown (2.5Y 5/2) fine sandy loam; few fine faint light brownish gray (2.5Y 6/2) and common medium distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; friable; 1 percent pebbles; mildly alkaline; gradual wavy boundary.

Bg2—24 to 30 inches; grayish brown (2.5Y 5/2) fine sandy loam; many medium faint dark grayish brown (2.5Y 4/2) and common fine distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; friable; 1 percent pebbles; slight effervescence; mildly alkaline; abrupt wavy boundary.

2C—30 to 34 inches; olive brown (2.5Y 4/4) loamy sand; common fine distinct light olive brown (2.5Y 5/6) and common medium distinct grayish brown (2.5Y 5/2) mottles; weak fine subangular blocky structure; very friable; 10 percent pebbles; slight effervescence; moderately alkaline; abrupt wavy boundary.

3C—34 to 60 inches; stratified grayish brown (2.5Y 5/2) silt loam and very fine sand; many coarse prominent gray and grayish brown (2.5Y 5/4 and 2.5Y 5/6) and few fine prominent reddish brown (5Y 5/3) mottles; massive parting to strong thick platy structure; friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 40 inches, and the depth to free carbonates ranges from 24 to 40 inches. The solum ranges from medium acid to mildly alkaline. Pebble content ranges from 0 to 15 percent throughout the pedon. The mollic epipedon is 10 to 12 inches thick.

The Ap horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 0 to 3. It is dominantly fine sandy loam, but the range includes loamy very fine sand, very fine sandy loam, or silt loam.

The Bg horizon has hue of 10Y or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is dominantly fine sandy loam, but the subhorizons may have textures that range from fine sand to sandy clay loam and silty clay loam.

The C horizons have hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 0 to 4. Textures of the stratified material range widely from fine sand to silt. Reaction in the C horizons is mildly alkaline or moderately alkaline.

Londo Series

The Londo series consists of deep, somewhat poorly drained, moderately or moderately slowly permeable soils on till plains, till plains modified by glacial lake waters, and moraines. These soils formed in loamy glacial till. The slope ranges from 0 to 6 percent.

The Londo soils in this survey area are a taxadjunct to the Londo series because they do not have an albic horizon tonguing into the argillic horizon, as is defined for the Londo series. This difference does not alter the usefulness or behavior of the soils.

The Londo soils are similar to Metamora and Ithaca soils and are commonly adjacent to Guelph, Parkhill, and Selfridge soils. The Metamora soils have less clay in the solum. The Ithaca soils have more clay in the solum and substratum. The Guelph soils are well drained and are higher on the landscape than the Londo soils. The Parkhill soils are poorly drained and are lower on the landscape than the Londo soils. The Selfridge soils have less clay in the solum. They and the Londo soils are in similar positions on the landscape.

Typical pedon of Londo loam, 0 to 3 percent slopes, 160 feet east and 1,400 feet north of the southwest corner of sec. 27, T. 14 N., R. 4 W., Union Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

B/E—9 to 14 inches; yellowish brown (10YR 5/4) loam (Bt) with pale brown (10YR 6/3) sandy loam, very pale brown (10YR 7/3) dry (E) as coatings on surfaces of peds and along root and worm channels; few fine distinct yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure parting to weak fine granular; few thin dark yellowish brown (10YR 4/4) clay films on surfaces of peds; friable; neutral; clear irregular boundary.

Bt—14 to 22 inches; dark yellowish brown (10YR 4/4) clay loam; few fine distinct (10YR 5/2) mottles; moderate fine and medium subangular blocky structure; firm; 1 percent pebbles; many thin dark brown (10YR 3/3 and 7.5YR 3/2) clay films on surface of peds and in root channels; neutral; abrupt irregular boundary.

C1—22 to 36 inches; grayish brown (10YR 5/2) loam; many medium faint brown (10YR 5/3) and common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; 2 percent pebbles; few thin streaks of white (10YR 8/2) secondary lime; strong effervescence; moderately alkaline; clear wavy boundary.

C2—36 to 60 inches; brown (10YR 5/3) loam; few fine faint grayish brown (10YR 5/2) and medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; 2 percent pebbles; common thin streaks of white (10YR 8/2) secondary lime; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 12 to 25 inches. Pebble content ranges from 0 to 10 percent throughout the pedon. The solum ranges from slightly acid to mildly alkaline.

The Ap horizon has value of 3 or 4 and chroma of 1 or 2. It is dominantly loam, but the range includes fine sandy loam, sandy loam, and loamy sand. The E portion of the B/E horizon has value of 5 or 6 and chroma of 2 or 3. It is sandy loam, fine sandy loam, loam, or loamy sand. Some pedons have a separate E horizon.

The Bt horizon and the B part of the B/E horizon have hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. They are loam or clay loam.

The C horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 to 6; and chroma of 2 to 6. It is loam or clay loam. Reaction is mildly alkaline or moderately alkaline.

Marlette Series

The Marlette series consists of deep, well drained, moderately slowly permeable soils on moraines and till plains. These soils formed in loamy glacial till. The slope ranges from 2 to 20 percent.

The Marlette soils are similar to Guelph, Perrinton, and Remus soils and are commonly adjacent to Londo soils. The Londo soils are somewhat poorly drained and are lower on the landscape than the Marlette soils. The Perrinton soils have more clay in the subsoil, and the Remus soils have less clay in the subsoil. The Guelph soils have a thinner solum.

Typical pedon of Marlette loam, 2 to 6 percent slopes, 2,510 feet south and 1,452 feet east of the northwest corner of sec. 9, T. 13 N., R. 4 W., Lincoln Township:

Ap—0 to 9 inches; dark brown (10YR 3/3) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; 2 percent pebbles; medium acid; abrupt smooth boundary.

B/E—9 to 18 inches; dark brown (7.5YR 4/4) clay loam (B) with pale brown (10YR 6/3) sandy loam, light gray (10YR 7/2) dry (E) coatings on surfaces of peds and along root channels; moderate medium subangular blocky structure; firm; 2 percent pebbles; medium acid; gradual wavy boundary.

Bt—18 to 40 inches; dark brown (10YR 4/3) clay loam; moderate medium angular blocky structure; friable; many thin dark yellowish brown (10YR 4/4) clay films on surfaces of peds and root channels; 2 percent pebbles; slightly acid; clear wavy boundary.

C—40 to 60 inches; yellowish brown (10YR 5/4) clay loam; few fine prominent strong brown (7.5YR 5/8) mottles; massive; friable; 2 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 25 to 40 inches. The solum ranges from medium acid to neutral. Pebble content ranges from 2 to 10 percent in the pedon.

The Ap horizon has value of 3 to 5 and chroma of 2 or 3. The E portion of the B/E horizon has value of 5 to 7 and chroma of 1 to 3. The A and E horizons are dominantly loam, but the range includes sandy loam or fine sandy loam. Some pedons have a separate E2 horizon.

The Bt horizon and B part of the B/E horizon have value of 4 to 6 and chroma of 3 to 6. They are dominantly clay loam, but the range includes loam and silty clay loam.

The C horizon has value of 4 to 6 and chroma of 2 to 4. It is loam or clay loam. Reaction is neutral to moderately alkaline.

Mecosta Series

The Mecosta series consists of deep, somewhat excessively drained soils on stream terraces and outwash plains. The soils formed in sandy and gravelly sandy deposits. Permeability is rapid in the upper part of the pedon and very rapid in the lower part. The slope ranges from 0 to 3 percent.

The Mecosta soils are similar to Plainfield soils and are commonly adjacent to Guelph and Cohoctah soils. The Plainfield soils have less clay and gravel in the

subsoil and substratum. The Guelph soils have more clay throughout the solum and substratum. They and the Mecosta soils are in similar positions on the landscape. The Cohoctah soils are poorly drained and are on flood plains.

Typical pedon of Mecosta sand, 0 to 3 percent slopes, 2,840 feet east and 200 feet south of the northwest corner of sec. 21, T. 14 N., R. 4 W., Union Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; 10 percent pebbles; medium acid; abrupt smooth boundary.

Bw1—9 to 20 inches; strong brown (7.5YR 4/6) sand; single grained; loose; 15 percent pebbles; slightly acid; abrupt broken boundary.

Bw2—20 to 24 inches; dark brown (7.5YR 3/4) gravelly loamy sand; weak fine subangular blocky structure; very friable; clay bridging between sand grains; 35 percent pebbles; slightly acid; abrupt wavy boundary.

Bw3—24 to 30 inches; dark yellowish brown (10YR 4/6) gravelly sand; single grained; loose; 35 percent pebbles; neutral; clear irregular boundary.

2BC—30 to 39 inches; yellowish brown (10YR 5/6) very gravelly sand; single grained; loose; 55 percent pebbles; neutral; abrupt irregular boundary.

2C—39 to 60 inches; yellowish brown (10YR 5/4) extremely gravelly sand; single grained; loose; 65 percent pebbles; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 20 to 40 inches. Pebble content ranges from 1 to 25 percent in the upper part of the solum and from 25 to 50 percent in the lower part. The solum ranges from strongly acid to neutral.

The Ap horizon is dominantly sand, but the range includes loamy sand.

The Bw horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is loamy sand, sand, or the gravelly or very gravelly analogues of these textures. Some pedons do not have a BC horizon.

The 2C horizon has value of 5 or 6 and chroma of 3 or 4. It is very gravelly sand or extremely gravelly sand. Pebble content ranges from 35 to 65 percent. The 2C horizon is mildly alkaline or moderately alkaline.

Metamora Series

The Metamora series consists of deep, somewhat poorly drained soils on till plains, till plains modified by glacial lake waters, outwash plains, and moraines. These soils formed in loamy glaciofluvial deposits and in the underlying loamy glacial till. Permeability is moderately rapid in the upper part of the pedon and moderately slow in the lower part. The slope ranges from 0 to 3 percent.

The Metamora soils are similar to Londo and Ithaca soils and are commonly adjacent to Londo, Parkhill, and Guelph soils. The Londo and Ithaca soils have more clay in the subsoil. The Parkhill soils are poorly drained and are lower on the landscape than the Metamora soils. The Guelph soils are well drained and are higher on the landscape than the Metamora soils.

Typical pedon of Metamora fine sandy loam, 0 to 3 percent slopes, 1,055 feet south and 1,400 feet east of the northwest corner of sec. 34, T. 13 N., R. 4 W., Lincoln Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

Bw1—9 to 21 inches; dark brown (10YR 4/3) sandy loam; few fine distinct yellowish brown (10YR 5/6) and common medium faint dark grayish brown (10YR 4/2) mottles; weak fine subangular blocky structure; friable; neutral; abrupt wavy boundary.

Bw2—21 to 24 inches; dark yellowish brown (10YR 4/4) loamy sand; few fine distinct yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; very friable; neutral; abrupt wavy boundary.

2Bt—24 to 33 inches; dark yellowish brown (10YR 4/4) clay loam; many medium prominent reddish brown (5YR 5/3) and common fine distinct yellowish brown (10YR 5/6) mottles; fine moderate subangular blocky structure; friable; many thin dark grayish brown (10YR 4/2) clay films on surfaces of peds; neutral; abrupt wavy boundary.

2C—33 to 60 inches; brown (10YR 5/3) loam; many coarse prominent reddish brown (5YR 5/3) and many coarse distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; many thin streaks of light gray (10YR 7/2) secondary lime; violent effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 18 to 40 inches. The upper part of the solum ranges from neutral to medium acid, and the lower part is neutral or slightly acid. Pebble content ranges from 0 to 10 percent in the pedon.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes sandy loam and loamy sand.

The Bw horizon has value of 4 to 6 and chroma of 3 or 4. It is sandy loam or loamy sand. The 2Bt horizon has value of 4 or 5 and chroma of 2 to 4. It is clay loam or loam. Some pedons have a Bt horizon of sandy loam or loam above the 2B horizon.

The 2C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 or 3. It is clay loam or loam.

Metea Series

The Metea series consists of deep, well drained soils on till plains and moraines. These soils formed in sandy glaciofluvial deposits and in the underlying loamy glacial till. Permeability is rapid in the upper part of the pedon and moderate in the lower part. The slope ranges from 1 to 6 percent.

The Metea soils in this survey area are a taxadjunct to the Metea series because they have a slightly thinner argillic horizon and a thinner solum than is defined for the Metea series. This difference does not alter the usefulness or behavior of the soils.

The Metea soils are similar to Ormas soils and are commonly adjacent to Spinks and Perrinton soils. The Ormas soils have a substratum of sand and gravel. The Spinks soils are sandy throughout the solum and substratum. The Perrinton soils have more clay in the solum and substratum. The Spinks and Perrinton soils and the Metea soils are in similar positions on the landscape.

Typical pedon of Metea loamy sand, 1 to 6 percent slopes, 80 feet east and 2,000 feet north of the southwest corner of sec. 21, T. 14 N., R. 6 W., Broomfield Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; less than 2 percent pebbles; neutral; abrupt smooth boundary.

Bw1—9 to 20 inches; dark yellowish brown (10YR 4/6) loamy sand; weak medium subangular blocky structure parting to weak fine granular structure; less than 2 percent pebbles; very friable; neutral; abrupt wavy boundary.

Bw2—20 to 22 inches; yellowish brown (10YR 5/4) loamy sand; weak fine granular structure; less than 2 percent pebbles; very friable; neutral; abrupt wavy boundary.

2Bt—22 to 28 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; about 5 percent pebbles; friable; neutral; abrupt irregular boundary.

2C1—28 to 40 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; about 5 percent pebbles; friable; slight effervescence; mildly alkaline; clear irregular boundary.

2C2—40 to 56 inches; yellowish brown (10YR 5/4) loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; about 5 percent pebbles; firm; many thin streaks of light gray (10YR 7/2) secondary lime; strong effervescence; mildly alkaline; clear irregular boundary.

2C3—56 to 60 inches; yellowish brown (10YR 5/4) loam; many medium faint brown (10YR 5/3) mottles; massive; about 5 percent pebbles; firm; many thin streaks of light gray (10YR 7/2) secondary lime; violent effervescence; moderately alkaline.

The solum is 26 to 36 inches thick. The sandy upper horizons range from 20 to 30 inches thick. Pebble content ranges from 0 to 15 percent in the pedon. The solum ranges from medium acid to neutral.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. It is dominantly loamy sand, but the range includes loamy fine sand or sand.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 2 to 6. It is sand, loamy sand, or loamy fine sand.

The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam or clay loam. Some pedons have a thin sandy loam Bt horizon above the 2Bt horizon.

The 2C horizon has hue of 4 or 5 and chroma of 3 to 6. It is loam or clay loam. Reaction in the 2C horizon is mildly alkaline or moderately alkaline.

Minoa Series

The Minoa series consists of deep, somewhat poorly drained soils on till plains modified by glacial lake waters. These soils formed in stratified loamy and sandy glaciofluvial sediments. Permeability is moderate in the upper part of the pedon and moderate or moderately rapid in the lower part. The slope ranges from 0 to 3 percent.

The Minoa soils are commonly adjacent to Parkhill, Wasepi, and Selfridge soils. The Parkhill soils are poorly drained and are lower on the landscape than the Minoa soils. The Wasepi soils have more sand and gravel in the substratum, and the Selfridge soils have more clay in the substratum. The Wasepi and Selfridge soils are similar to the Minoa soils in position on the landscape.

Typical pedon of Minoa loamy fine sand, 0 to 3 percent slopes, 250 feet south and 300 feet west of northeast corner of sec. 12, T. 13 N., R. 5 W., Fremont Township:

Ap—0 to 10 inches; dark brown (10YR 3/3) loamy fine sand; pale brown (10YR 6/3) dry; fine weak granular structure; very friable; 1 percent pebbles; medium acid; abrupt smooth boundary.

BA—10 to 18 inches; yellowish brown (10YR 5/4) loamy fine sand; few fine distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; very friable; 1 percent pebbles; neutral; clear wavy boundary.

Bw1—18 to 27 inches; stratified olive brown (2.5Y 4/4) loamy very fine sand and loamy fine sand; common fine distinct yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; very friable; discontinuous 1/16- to 1/2-inch thick, dark yellowish

brown (10YR 4/4) very fine sandy loam lamellae; neutral; clear wavy boundary.

Bw2—27 to 38 inches; stratified yellowish brown (10YR 5/4) loamy very fine sand and loamy fine sand; common medium distinct dark yellowish brown (10YR 4/6), yellowish brown (10YR 5/6), and grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; very friable; discontinuous 1/16- to 1/2-inch thick, dark yellowish brown (10YR 3/6) very fine sandy loam and loam lamellae; mildly alkaline; abrupt wavy boundary.

C1—38 to 50 inches; stratified brown (10YR 5/3) very fine sand, silt and loam; many coarse prominent light olive brown (2.5Y 5/4) and common medium distinct yellowish brown (10YR 5/6) and common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; very friable; strong effervescence; moderately alkaline; clear wavy boundary.

C2—50 to 60 inches; stratified yellowish brown (10YR 5/4) very fine sand, silt, silt loam, and silty clay loam; many coarse prominent light olive brown (2.5Y 5/4) and common medium distinct yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) mottles; massive; very friable; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 26 to 40 inches. The solum ranges from medium acid to mildly alkaline. Pebble content ranges from 0 to 5 percent in the pedon.

The Ap horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 to 3. The value dry is 6 or more. It is dominantly loamy fine sand, but the range includes fine sandy loam, silt loam, and loamy very fine sand.

The BA and Bw horizons have value of 3 to 6 and chroma of 2 to 4. Textures of the stratified Bw horizon cover an extreme range from loamy fine sand to silt loam.

The C horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 2 to 6. Textures of the stratified C horizon cover an extreme range from fine sand to silt. Reaction in the C horizon is mildly alkaline or moderately alkaline.

Ormas Series

The Ormas series consists of deep, well-drained soils on outwash plains, stream terraces, beach ridges, glacial deltas, and moraines. They formed in sandy and loamy glaciofluvial deposits over sand and gravel deposits (fig. 16). Permeability is moderately rapid in the solum and very rapid in the substratum. The slope ranges from 0 to 18 percent.

The Ormas soils in this survey area are a taxadjunct to the Ormas series because the solum is slightly thinner than is definitive for the Ormas series. This difference does not alter the usefulness or behavior of the soils.

The Ormas soils are similar to Metea soils and are commonly adjacent to Marlette, Spinks, and Coloma soils. The Metea soils have more clay in the substratum, the Marlette soils have more clay throughout the solum and substratum, and the Spinks and Coloma soils have less gravel in the substratum. The Marlette, Spinks, and Coloma soils and the Ormas soils are in similar positions on the landscape.

Typical pedon of Ormas sand, 0 to 6 percent slopes, 450 feet south and 2,000 feet east of the northwest corner of sec. 17, T. 14 N., R. 6 W., Broomfield Township:

Ap—0 to 8 inches; dark brown (10YR 3/3) sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; 2 percent pebbles; slightly acid; abrupt smooth boundary.

E1—8 to 16 inches; yellowish brown (10YR 5/6) sand; single grained; loose; 5 percent pebbles; slightly acid; abrupt broken boundary.

E2—16 to 22 inches; yellowish brown (10YR 5/4) sand; single grained; loose; 5 percent pebbles; slightly acid; abrupt wavy boundary.

Bt—22 to 33 inches; dark brown (7.5YR 4/4) sandy clay loam and sandy loam; moderate fine and medium subangular blocky structure; friable; 15 percent pebbles; neutral; abrupt wavy boundary.

2C—33 to 60 inches; yellowish brown (10YR 5/6 and 10YR 5/4) very gravelly sand; single grained; loose; 50 percent pebbles; slight effervescence; mildly alkaline.

The thickness of the solum, the depth to the 2C horizon, and the depth to free carbonates range from 28 to 45 inches. Pebble content ranges from 1 to 25 percent in the solum and from 10 to 65 percent in the 2C horizon. The solum ranges from strongly acid to neutral.

The Ap horizon has hue of 10YR or 7.5Y, value of 3 to 5, and chroma of 2 or 3. It is dominantly sand, but the range includes loamy sand. The E horizon has value of 5 or 6 and chroma of 3 to 6. It is sand or loamy sand.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is sandy loam, sandy clay loam, gravelly sandy loam, or gravelly sandy clay loam.

The 2C horizon has value of 5 or 6 and chroma of 2 to 6. It is gravelly sand, very gravelly sand, extremely gravelly sand, or stratified sand and gravel. Reaction in the 2C horizon is mildly alkaline or moderately alkaline.

Parkhill Series

The Parkhill series consists of deep, poorly drained soils in depressions on till plains, till plains modified by glacial lake waters, and moraines. These soils formed in loamy glacial till. Permeability is moderately slow in the

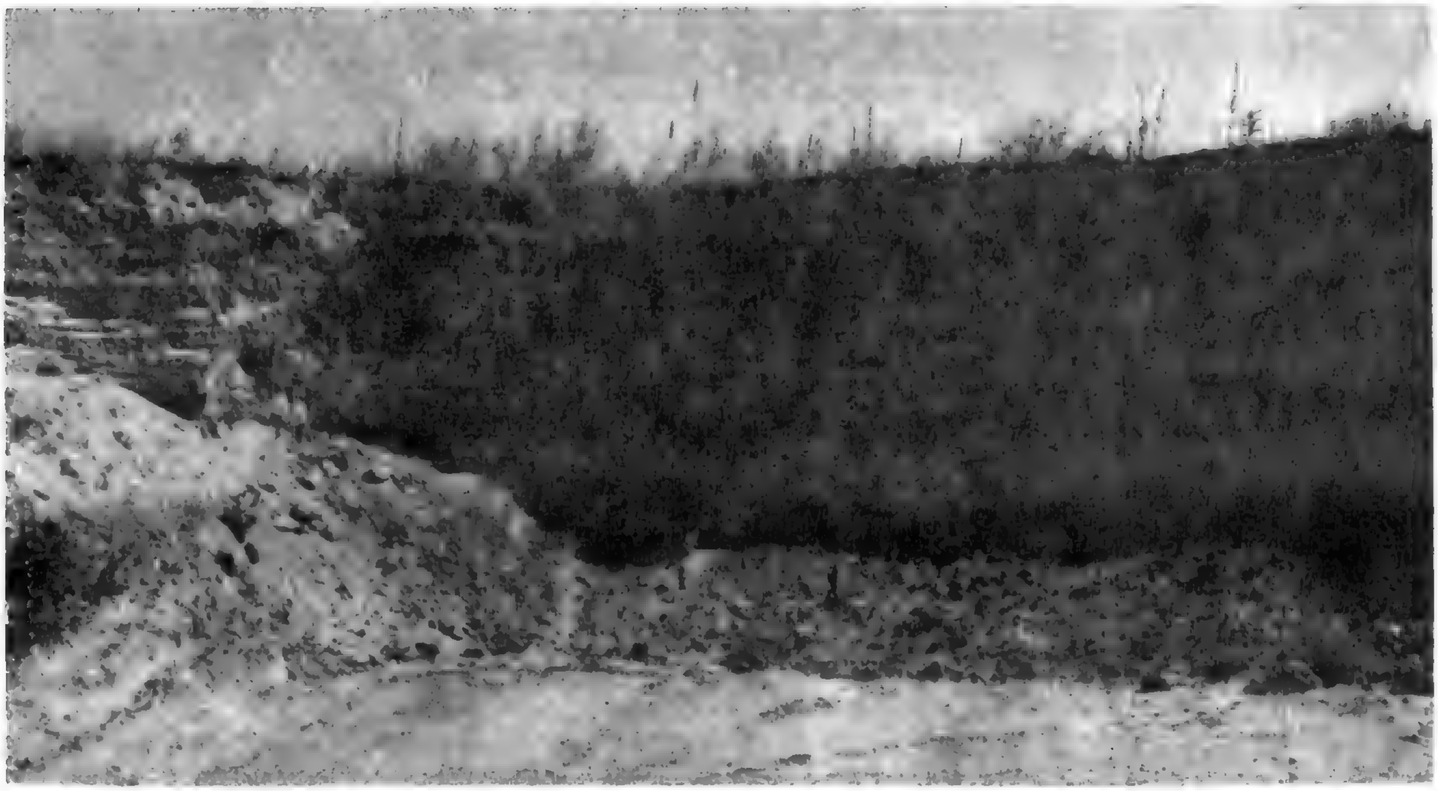

Figure 16.—Ormas sand is used as a source of sand and gravel.

upper part of the pedon and moderate in the lower part. The slope is 0 to 2 percent.

The Parkhill soils are similar to Corunna soils and are commonly adjacent to Guelph and Londo soils. The Corunna soils have less clay in the subsoil. The Guelph soils are well drained, and the Londo soils are somewhat poorly drained. The Guelph and Londo soils are higher on the landscape than the Parkhill soils.

Typical pedon of Parkhill loam, 780 feet north and 75 feet east of the southwest corner of sec. 3, T. 13 N., R. 3 W., Coe Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

Bg—9 to 35 inches; grayish brown (10YR 5/2) loam; many coarse prominent strong brown (7.5YR 5/6) mottles and common medium faint very dark grayish brown (10YR 3/2) organic stains; weak medium subangular blocky structure; friable; mildly alkaline; abrupt wavy boundary.

Cg—35 to 60 inches; grayish brown (10YR 5/2) loam; many coarse distinct dark yellowish brown (10YR 4/4), common fine prominent reddish brown (5YR 5/3), and common medium prominent yellowish brown (10YR 5/6) mottles; massive; very sticky; common thin streaks of white (10YR 8/2) secondary lime; violent effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 20 to 45 inches. Pebble content ranges from 0 to 10 percent throughout the pedon. The solum ranges from slightly acid to mildly alkaline.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loam, but the range includes sandy loam and silt loam.

The Bg horizon has hue of 10YR, 2.5YR, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is loam or clay loam.

The C horizon has hue of 10YR, 2.5YR, or 5Y; value of 4 to 6; and chroma of 1 to 4. It is mildly alkaline or moderately alkaline.

Perrinton Series

The Perrinton series consists of deep, well drained, moderately slowly permeable soils on till plains and moraines. These soils formed in loamy glacial till. The slope ranges from 2 to 18 percent.

The Perrinton soils are similar to Guelph, Marlette, and Remus soils and are commonly adjacent to Ithaca and Ziegenfuss soils. The Guelph, Marlette, and Remus soils have less clay in the subsoil. The Ithaca soils are somewhat poorly drained, and the Ziegenfuss soils are poorly drained. The Ithaca and Ziegenfuss soils are lower on the landscape than the Perrinton soils.

Typical pedon of Perrinton loam, 2 to 6 percent slopes, 1,720 feet east and 1,350 feet south of the northwest corner of sec. 22, T. 15 N., R. 5 W., Nottawa Township:

Ap—0 to 11 inches; dark brown (10YR 4/3) loam; light gray (10YR 7/2) dry; weak fine granular structure; friable; 2 percent pebbles; medium acid; abrupt smooth boundary.

B/E—11 to 16 inches; dark brown (7.5YR 4/4) clay loam (B) and brown (10YR 5/3) loam, pale brown (10YR 6/3) dry (E) as coatings on surfaces of peds and along root channels; moderate medium subangular blocky structure; friable; 2 percent pebbles; medium acid; abrupt irregular boundary.

Bt1—16 to 24 inches; dark yellowish brown (10YR 4/6) clay loam; moderate medium subangular blocky structure; firm; 2 percent pebbles; many thin dark yellowish brown (10YR 4/4) clay films on surfaces of peds and in root channels; medium acid; clear wavy boundary.

Bt2—24 to 36 inches; dark yellowish brown (10YR 4/4) clay loams; few black (10YR 2/1) organic stains in root channels; moderate strong subangular blocky structure; firm; 2 percent pebbles; many thin dark brown (10YR 4/3) clay films on surfaces of peds and in root channels; neutral; abrupt wavy boundary.

C—36 to 60 inches; yellowish brown (10YR 5/4) clay loam; massive; firm; 2 percent pebbles; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 20 to 40 inches. Pebble content ranges from 2 to 10 percent throughout the pedon. The solum ranges from medium acid to neutral.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loam, but the range includes sandy loam. The E portion of the B/E horizon has value of 4 to 6 and chroma of 2 to 4. It is loam or sandy loam. Some pedons have a separate E horizon.

The Bt horizon and B part of the B/E have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4.

The C horizon has value of 4 or 5 and chroma of 3 or 4. It is loam or clay loam. Reaction in the C horizon is mildly alkaline or moderately alkaline.

Pinnebog Series

The Pinnebog series consists of deep, very poorly drained, moderately slowly to moderately rapidly permeable organic soils in bogs and other depressional areas on outwash plains, till plains, and moraines. These soils formed in decomposed herbaceous materials. The slope ranges from 0 to 2 percent.

The Pinnebog soils are commonly adjacent to Spinks and Remus soils. The Spinks and Remus soils are well drained and are higher on the landscape than the Pinnebog soils.

Typical pedon of Pinnebog muck, 1,980 feet west and 1,150 feet north of the southeast corner of sec. 25, T. 13 N., R. 4 W., Lincoln Township:

Oa1—0 to 11 inches; black (N 2/0) broken face and rubbed sapric material; less than 5 percent fiber unrubbed, less than 1 percent rubbed; moderate medium granular structure; very friable; primarily herbaceous fibers; neutral; clear wavy boundary.

Oa2—11 to 18 inches; black (N 2/0) broken face and rubbed sapric material; about 5 percent fiber unrubbed, less than 1 percent rubbed; moderate medium subangular blocky structure; friable; primarily herbaceous fibers; neutral; abrupt wavy boundary.

Oe—18 to 26 inches; dark reddish brown (5YR 3/3) broken face and rubbed hemic material; about 75 percent fiber unrubbed, about 25 percent rubbed; weak thin platy structure; friable; primarily herbaceous fibers; neutral; abrupt wavy boundary.

O'a—26 to 41 inches; black (N 2/0) broken face and rubbed sapric material; about 10 percent fiber unrubbed, less than 1 percent rubbed; massive; primarily herbaceous fibers; slightly acid; abrupt wavy boundary.

O'e—41 to 45 inches; dark reddish brown (5YR 3/3) broken face and rubbed hemic material; about 75 percent fiber unrubbed, about 20 percent rubbed; massive; primarily herbaceous fibers; neutral; abrupt wavy boundary.

O"a—45 to 60 inches; very dark gray (5YR 3/1) broken face and rubbed sapric material; about 25 percent fiber unrubbed, less than 10 percent rubbed; massive; primarily herbaceous fibers; neutral.

The organic layers are more than 51 inches thick. The organic material is primarily herbaceous, but in many pedons, woody fragments are mixed throughout the organic layers. The organic material is neutral or has hue of 10YR, 7.5YR, 5YR; value of 1 to 3; and chroma of 0 to 3. Reaction ranges from medium acid to mildly alkaline.

The surface tier is typically sapric material, but the range includes hemic material.

At least 10 inches of the subsurface tier and bottom tier is hemic material. Some pedons have as much as 2 inches of limnic material in these tiers.

Pipestone Series

The Pipestone series consists of deep, somewhat poorly drained, rapidly permeable soils on beach ridges, glacial deltas, and outwash plains. These soils formed in sandy glaciofluvial deposits. The slope ranges from 0 to 3 percent.

The Pipestone soils in this survey area are a taxadjunct to the Pipestone series because they have a higher ratio of free iron to carbon than is defined for the Pipestone series. This difference does not alter the usefulness or behavior of the soils.

The Pipestone soils are similar to Covert soils and are commonly adjacent to Kingsville and Thetford soils. The Covert soils are moderately well drained. The Kingsville soils are poorly drained and are lower on the landscape than the Pipestone soils. The Thetford soils have more clay in the subsoil. They and the Pipestone soils are in similar positions on the landscape.

Typical pedon of Pipestone sand, 0 to 3 percent slopes, 1,740 feet east and 1,480 feet north of the southwest corner of sec. 14, T. 14 N., R. 3 W., Chippewa Township:

A—0 to 2 inches; black (N 2/0) sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; 1 percent pebbles; very strongly acid; abrupt wavy boundary.

E—2 to 4 inches; light brownish gray (10YR 6/2) sand, light gray (10YR 7/1) dry; few fine distinct yellowish brown (10YR 5/4) and common coarse distinct brown (7.5YR 5/2) mottles; single grained; loose; very strongly acid; abrupt wavy boundary.

Bh—4 to 11 inches; dark brown (7.5YR 3/4) sand; common fine distinct strong brown (7.5YR 5/6) mottles; weak fine and medium subangular blocky structure; very friable; strongly acid; clear broken boundary.

Bs—11 to 19 inches; dark brown (7.5YR 4/4) sand; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very friable; very strongly acid; clear broken boundary.

BC—19 to 31 inches; dark yellowish brown (10YR 4/6) sand; common fine distinct dark brown (7.5YR 4/4) mottles; single grained; loose; strongly acid; gradual irregular boundary.

C—31 to 60 inches; yellowish brown (10YR 5/4) sand; common medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; strongly acid.

The solum is 20 to 50 inches thick. The pebble content ranges from 0 to 10 percent in the solum. The solum ranges from very strongly acid to neutral.

The A horizon has value of 2 to 4 and chroma of 0 to 2. It is dominantly sand, but the range includes fine sand, loamy sand, or loamy fine sand. The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 to 3. It is sand or fine sand.

The Bs horizon has hue of 5YR, 7.5YR, or 10YR; value of 2 to 5; and chroma of 2 to 8. It is sand or fine sand. Some pedons have as much as 30 percent ortstein within the Bs horizon. Some pedons do not have a BC horizon.

The C horizon has value of 5 to 7 and chroma of 2 to 6. It is sand or fine sand. Reaction in the C horizon ranges from medium acid to neutral.

Plainfield Series

The Plainfield series consists of excessively drained, rapidly permeable soils on outwash plains, stream terraces, and moraines. These soils formed in sandy glacial drift. The slope ranges from 0 to 18 percent.

The Plainfield soils are similar to Coloma, Spinks, and Mecosta soils and are commonly adjacent to Spinks, Pipestone, and Remus soils. The Coloma, Spinks, and Mecosta soils have more clay in the subsoil. The Pipestone soils are somewhat poorly drained and are lower on the landscape than the Plainfield soils. The Remus soils have more clay throughout the solum and substratum. They and the Plainfield soils are in similar positions on the landscape.

Typical pedon of Plainfield sand, 0 to 6 percent slopes, 120 feet west and 350 feet north of the southeast corner of sec. 4, T. 14 N., R. 6 W., Broomfield Township:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) sand, brown (10YR 5/3) dry; single grained; loose; 1 percent pebbles; strongly acid; abrupt smooth boundary.

Bw—7 to 21 inches; strong brown (7.5YR 4/6) sand; single grained; loose; 1 percent pebbles; strongly acid; abrupt wavy boundary.

C1—21 to 55 inches; yellowish brown (10YR 5/8) sand; single grained; loose; 2 percent pebbles; strongly acid; abrupt wavy boundary.

C2—55 to 60 inches; yellowish brown (10YR 5/4) sand; single grained; loose; 5 percent pebbles; slightly acid.

The thickness of the solum ranges from 18 to 34 inches. Pebble content ranges from 0 to 15 percent in the pedon. The solum ranges from strongly acid to slightly acid.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is dominantly sand, but the range includes loamy fine sand, loamy sand, or fine sand.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 3 through 6.

The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 4 to 8. It is typically sand, but thin subhorizons of fine sand occur in some pedons.

Reaction in the C horizon ranges from strongly acid to slightly acid.

Remus Series

The Remus series consists of deep, well drained, moderately permeable soils on till plains and moraines. These soils formed in loamy glacial till. The slope ranges from 1 to 35 percent.

The Remus soils in this survey area are a taxadjunct to the Remus series because they have tonguing of albic material into the argillic horizon rather than interfingering, as is defined for the series. This difference does not alter the usefulness or behavior of the soils.

The Remus soils are similar to Marlette, Guelph, Perrinton, and Tekenink soils and are commonly adjacent to Spinks and Coloma soils. The Marlette and Guelph soils have a thinner solum, and the Tekenink soils have less clay in the subsoil. The Perrinton soils have more clay in the subsoil. The Spinks and Coloma soils and the Remus soils are in similar positions on the landscape.

Typical pedon of Remus fine sandy loam, in an area of Remus-Spinks complex, 6 to 12 percent slopes, 2,000 feet west and 100 feet north of the southeast corner of sec. 21, T. 14 N., R. 6 W., Broomfield Township:

Ap—0 to 9 inches; dark brown (10YR 3/3) fine sandy loam, very pale brown (10YR 7/3) dry; weak fine granular structure; very friable; about 1 percent pebbles; strongly acid; abrupt smooth boundary.

E/B—9 to 20 inches; brown (10YR 5/3) sandy loam, light gray (10YR 7/2) dry (E) and dark yellowish brown (10YR 4/4) loam (Bt); moderate medium subangular blocky structure; the E portion occurs as continuous tongues surrounding B material, 5/16 inch to 1 1/8 inches thick and 10 inches long; friable; about 1 percent pebbles; strongly acid; gradual irregular boundary.

B/E—20 to 38 inches; dark yellowish brown (10YR 4/4) loam (Bt) and brown (10YR 5/3) sandy loam, light gray (10YR 7/2) dry (E); moderate medium subangular blocky structure; friable; about 1 percent pebbles; medium acid; gradual irregular boundary.

Bt—38 to 43 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular structure; friable; about 5 percent pebbles; medium acid; clear irregular boundary.

BC—43 to 52 inches; dark brown (10YR 4/3) sandy loam; moderate medium subangular blocky structure; friable; about 5 percent pebbles; slightly acid; abrupt irregular boundary.

C—52 to 60 inches; brown (7.5YR 5/4) sandy loam; massive; friable; about 5 percent pebbles; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 40 to more than 60 inches. Pebble content ranges from 0 to 15 percent in the pedon. The solum ranges from very strongly acid to neutral.

Cultivated areas have an Ap horizon 6 to 10 inches thick. It has hue of 10YR, value of 2 to 4, and chroma of 2 or 3. It is dominantly fine sandy loam or sandy loam, but the range includes loamy sand. Uncultivated areas have an A horizon, 2 to 5 inches thick above the E horizon. Some pedons have a Bw horizon and an E' horizon above the E/B horizon. The E' horizon has colors and textures similar to those in the E part of the E/B horizon.

The E part of the E/B and B/E horizons has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 4. It is fine sandy loam, sandy loam, or loamy sand. The Bt part of the E/B and B/E horizons has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is loam, sandy loam, or sandy clay loam. The Bt horizon has hue, colors, and textures similar to the B part of the B/E horizon. Some pedons do not have a BC horizon.

Where present, the C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 or 4. It is loam or sandy loam; however, pockets of sand or loamy sand are in some pedons. Reaction in the C horizon is mildly alkaline or moderately alkaline.

Selfridge Series

The Selfridge series consists of deep, somewhat poorly drained soils on beach ridges, outwash plains, till plains, till plains modified by glacial lake waters, and moraines. These soils formed in sandy glaciofluvial deposits and in the underlying loamy glacial drift. Permeability is rapid in the upper part of the pedon and moderately slow in the lower part. The slope ranges from 0 to 3 percent.

The Selfridge soils are similar to Wixom soils and are commonly adjacent to Londo, Parkhill, and Ithaca soils. The Wixom soils have a spodic horizon. The Londo and Ithaca soils have more clay throughout the solum. They and the Selfridge soils are in similar positions on the landscape. The Parkhill soils are poorly drained and are lower on the landscape than the Selfridge soils.

Typical pedon of Selfridge sand, 0 to 3 percent slopes, 210 feet east and 760 feet north of the southwest corner of sec. 16, T. 13 N., R. 4 W., Lincoln Township:

Ap—0 to 9 inches; dark brown (10YR 3/3) sand, brown (10YR 5/3) dry; single grained; loose; medium acid; abrupt smooth boundary.

E1—9 to 18 inches; yellowish brown (10YR 5/6) sand; single grained; loose; medium acid; clear wavy boundary.

E2—18 to 30 inches; yellowish brown (10YR 5/4) sand; single grained; loose; medium acid; clear irregular boundary.

Bt1—30 to 34 inches; dark yellowish brown (10YR 4/4) sandy loam; common fine distinct grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; very friable; clay bridging between sand grains; medium acid; abrupt wavy boundary.

2Bt2—34 to 38 inches; dark brown (10YR 4/3) clay loam; common fine distinct yellowish brown (10YR 5/6) and common fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; many thin dark brown (10YR 4/3) clay films on surfaces of peds and in root channels; mildly alkaline; abrupt wavy boundary.

2C—38 to 60 inches; brown (10YR 5/3) clay loam; many medium faint yellowish brown (10YR 5/4) and many medium distinct and yellowish brown (10YR 5/6) and few fine prominent reddish brown (5YR 5/3) mottles; massive; firm; many thin streaks of light gray (10YR 7/2) secondary lime; violent effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. The solum ranges from medium acid to neutral. Pebble content ranges from 0 to 10 percent in the pedon.

The Ap horizon has value of 2 or 3 and chroma of 1 to 3. Some pedons have a thin E horizon that ranges from 1 inch to 4 inches in thickness. The A and E horizons are dominantly sand, but the range includes loamy sand.

The E horizon has value of 4 or 5 and chroma of 3 to 6. It is sand or loamy sand. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. The 2Bt horizon has value of 4 to 6 and chroma of 1 to 3. It is loam, clay loam, or silty clay loam.

The 2C horizon has hue of 5YR, 7.5YR, or 10YR; value of 5 or 6; and chroma of 1 to 4. It is clay loam, loam, or silty clay loam. Some pedons have a gravelly sand C horizon above the loamy 2C horizon. Reaction in the 2C horizon is mildly alkaline or moderately alkaline.

Shoals Series

The Shoals series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in loamy and silty alluvium. The slope is 0 to 2 percent.

The Shoals soils in this survey area are a taxadjunct to the Shoals series because these soils do not have dominant low chroma in the substratum, as is defined for the series. This difference does not alter the usefulness or behavior of the soils.

The Shoals soils are commonly adjacent to Ithaca soils. The Ithaca soils have more clay in the subsoil and are not subject to flooding, as are Shoals soils.

Typical pedon of Shoals silt loam, 1,600 feet south and 150 feet west of the northeast corner of sec. 30, T. 15 N., R. 3 W., Denver Township:

A—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; neutral; abrupt wavy boundary.

C1—9 to 13 inches; dark brown (10YR 4/3) loam; few medium faint dark yellowish brown (10YR 4/4) and few medium distinct dark grayish brown (10YR 4/2) mottles; weak medium granular structure; friable; neutral; clear wavy boundary.

C2—13 to 34 inches; dark yellowish brown (10YR 4/6) silt loam; few medium prominent grayish brown (10YR 5/2) and many medium faint yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; mildly alkaline; gradual wavy boundary.

C3—34 to 40 inches; yellowish brown (10YR 5/6) silt loam; many medium distinct brown (10YR 5/3) mottles; weak moderate subangular blocky structure; friable; mildly alkaline; abrupt wavy boundary.

C4—40 to 55 inches; brown (10YR 5/3) stratified sand and sandy loam; few medium faint yellowish brown (10YR 5/4) mottles; few fine prominent organic stains (N 2/0); massive; friable; mildly alkaline; clear irregular boundary.

C5—55 to 60 inches; grayish brown (10YR 5/2) stratified clay loam, sandy loam, and gravelly sand; few medium faint yellowish brown (10YR 5/4) mottles; few fine prominent organic stains (N 2/0); massive; friable; slight effervescence; mildly alkaline.

The A horizon has value of 3 to 5. It is typically silt loam, but the range includes loam.

The C horizon has value of 4 or 5 and chroma of 2 to 6. Typically, it is silt loam, but the range includes loam.

Spinks Series

The Spinks series consists of deep, well drained, moderately rapidly permeable soils on outwash plains, moraines, and till plains. These soils formed in sandy glaciofluvial deposits or in sandy glacial till. The slope ranges from 0 to 35 percent.

The Spinks soils are similar to Arkport, Coloma, and Plainfield soils and are commonly adjacent to Plainfield, Remus, and Ormas soils. Coloma soils have less than 6 inches total accumulation of lamellae. The Plainfield soils are excessively well drained. The Arkport soils have more clay in the lamellae. The Ormas soils have a coarser substratum. The Remus soils have more clay throughout the solum and substratum. The Ormas and Remus soils and the Spinks soils are in similar positions on the landscape.

Typical pedon of Spinks sand, 0 to 6 percent slopes, 160 feet west and 2,250 feet north of the southeast corner of sec. 6, T. 13 N., R. 6 W., Rolland Township:

Ap—0 to 9 inches; dark brown (10YR 3/3) sand, brown (10YR 5/3) dry; weak fine granular structure; very

friable; about 2 percent pebbles; strongly acid; abrupt smooth boundary.

E—9 to 20 inches; yellowish brown (10YR 5/4) sand, very pale brown (10YR 7/4) dry; single grained; loose; about 2 percent pebbles; medium acid; clear wavy boundary.

E&Bt—20 to 60 inches; light yellowish brown (10YR 6/4) sand (E), very pale brown (10YR 7/4) dry; single grained; loose; discontinuous, 1/8- to 3-inch thick, strong brown (7.5YR 4/6) loamy sand lamellae (Bt); weak medium subangular blocky structure; very friable; medium acid.

The thickness of the solum and the depth to free carbonates range from 36 to more than 60 inches. Pebble content ranges from 0 to 15 percent in the pedon. The solum ranges from medium acid to neutral.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. It is dominantly sand, but the range includes loamy sand, fine sand, and loamy fine sand. In uncultivated areas an A horizon is present, and it has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 3 to 6. It is sand, loamy sand, or fine sand.

The E part of the E&Bt horizon has colors and textures like those in the E horizon. The B part of the E&Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The lamellae are dominantly loamy sand, but the range includes sand, loamy fine sand, and sandy loam. The individual lamellae range from 1/8 inch to 5 inches in thickness. The depth to the first lamellae ranges from 15 to 40 inches.

Some pedons have a C horizon that has hue of 10YR, value of 5 to 7, and chroma of 3 or 4. Its texture is sand. Reaction in the C horizon ranges from neutral to moderately alkaline.

Tekenink Series

The Tekenink series consists of deep, well drained, moderately permeable soils on moraines and till plains. These soils formed in loamy glacial till. The slope ranges from 2 to 18 percent.

The Tekenink soils are similar to Remus soils and are commonly adjacent to Marlette, Remus, and Spinks soils. The Remus soils have more clay in the subsoil, and the Marlette soils have more clay throughout the solum and substratum. The Spinks soils are coarser in texture. The Marlette and Spinks soils and the Tekenink soils are in similar positions on the landscape.

Typical pedon of Tekenink loamy fine sand, 2 to 6 percent slopes, 75 feet south and 1,150 feet west of the northeast corner of sec. 10, T. 14 N., R. 6 W., Broomfield Township:

Ap—0 to 11 inches; dark brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; about 2 percent pebbles; medium acid; abrupt smooth boundary.

E—11 to 16 inches; yellowish brown (10YR 5/4) loamy fine sand, very pale brown (10YR 7/4) dry; weak fine granular structure; very friable; 1 percent pebbles; strongly acid; clear broken boundary.

B/E—16 to 33 inches; dark brown (7.5YR 4/4) loam (Bt) and brown (10YR 5/3) loamy sand, white (10YR 8/2) dry (E) as coatings on surfaces of peds and along root channels; moderate medium and fine subangular blocky structure; very friable; 2 percent pebbles; strongly acid; abrupt wavy boundary.

Bt—33 to 46 inches; strong brown (7.5YR 4/6) sandy loam; moderate medium and fine subangular blocky structure; very friable; 2 percent pebbles; few fine dark brown (7.5YR 4/3) clay films on ped surfaces and in root channels; slightly acid; abrupt wavy boundary.

C—46 to 60 inches; yellowish brown (10YR 5/4) sandy loam; massive; very friable; discontinuous, 1- to 2-inch thick lenses of loamy sand; 5 percent pebbles; few thin streaks of very pale brown (10YR 7/3) secondary lime; violent effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 40 to more than 60 inches. The solum ranges from strongly acid to slightly acid. Pebble content ranges from 0 to 15 percent throughout the pedon.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. The value dry is 6 or more. The E horizon has value of 5 to 7 and chroma of 2 to 4. The A and E horizons are dominantly loamy fine sand, but the range includes sand, fine sand, loamy sand, sandy loam, and fine sandy loam.

The E part of the B/E horizon has colors and textures similar to those in the E horizon.

The Bt horizon and B part of the B/E horizon have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. They are sandy loam or loam. Some pedons also contain subhorizons of sandy clay loam or loamy sand.

The C horizon has value of 5 or 6 and chroma of 3 to 6. It is mildly alkaline or moderately alkaline.

Thetford Series

The Thetford series consists of deep, somewhat poorly drained soils on outwash plains, till plains, and till plains modified by glacial lake waters. These soils formed in sandy glaciofluvial deposits or sandy glacial till. Permeability is moderately rapid in the upper part of the pedon and rapid in the lower part. The slope ranges from 0 to 3 percent.

The Thetford soils are similar to Pipestone soils and are commonly adjacent to Pipestone, Selfridge, and Spinks soils. The Pipestone soils have less clay in the

subsoil. The Selfridge soils have more clay in the subsoil and substratum. They and the Thetford soils are in similar positions on the landscape. The Spinks soils are well drained and are higher on the landscape than the Thetford soils.

Typical pedon of Thetford loamy sand, 0 to 3 percent slopes, 2,310 feet east and 2,270 feet south of the northwest corner of sec. 29, T. 13 N., R. 3 W., Coe Township:

Ap—0 to 10 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; very friable; medium acid; abrupt smooth boundary.

E—10 to 27 inches; yellowish brown (10YR 5/4) sand, very pale brown (10YR 7/4) dry; common medium distinct pale brown (10YR 6/3) and few fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; slightly acid; clear wavy boundary.

E&Bt—27 to 38 inches; light yellowish brown (10YR 6/4) sand (E), very pale brown (10YR 7/3) dry; single grained; loose; discontinuous, 1/4- to 3-inch thick, dark yellowish brown (10YR 4/6) loamy sand lamellae with few fine distinct grayish brown (10YR 5/2) mottles (Bt); weak fine subangular blocky structure; very friable; clay bridging between sand grains in Bt; neutral; abrupt broken boundary.

C—38 to 60 inches; yellowish brown (10YR 5/6) sand; few fine and medium prominent light brownish gray (10YR 6/2) and yellowish red (5YR 4/6) and common fine distinct strong brown (7.5YR 5/6) mottles; single grained; loose; neutral.

The thickness of the solum and the depth to free carbonates range from 30 to more than 60 inches. Pebble content ranges from 0 to 5 percent in the solum. The solum ranges from medium acid to neutral.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is dominantly loamy sand, but the range includes sand, fine sand, and loamy fine sand.

The E horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is sand, loamy sand, fine sand, or loamy fine sand.

The E part of the E&Bt and Bt&E horizons has colors and textures similar to those in the A2 horizon. The Bt part of the E&Bt and Bt&E horizons has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The lamellae are dominantly loamy sand, but the range includes sand, loamy fine sand, and sandy loam. The individual lamellae range from 1/4 inch to 3 inches in thickness.

The C horizon has value of 5 or 6 and chroma of 1 to 6. It is sand, fine sand, or very fine sand. Pebble content ranges from 0 to 25 percent. Reaction ranges from neutral to moderately alkaline.

Wasepi Series

The Wasepi series consists of deep, somewhat poorly drained soils on beach ridges, outwash plains, glacial deltas, and till plains modified by glacial lake waters. These soils formed in sandy and loamy glaciofluvial deposits over sandy and gravelly deposits. Permeability is moderately rapid in the solum and very rapid in the substratum. The slope ranges from 0 to 3 percent.

The Wasepi soils are commonly adjacent to Thetford, Selfridge, and Gilford soils. The Thetford soils have textural bands and have less gravel in the substratum. The Selfridge soils have more clay in the substratum. The Thetford and Selfridge soils are similar to Wasepi soils in position on the landscape. The Gilford soils are very poorly drained and are lower on the landscape than the Wasepi soils.

Typical pedon of Wasepi loamy sand, 0 to 3 percent slopes, 1,745 feet north and 330 feet west of the southeast corner of sec. 25, T. 13 N., R. 4 W., Lincoln Township:

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; 3 percent pebbles; medium acid; abrupt smooth boundary.

Bt—10 to 21 inches; yellowish brown (10YR 5/6) sandy loam; few fine prominent dark grayish brown (10YR 4/2) mottles; weak fine subangular blocky structure; friable; clay bridging between sand grains and few thin dark yellowish brown (10YR 4/4) clay films; 5 percent pebbles; slightly acid; abrupt wavy boundary.

BC—21 to 28 inches; yellowish brown (10YR 5/4) loamy sand; few fine distinct yellowish brown (10YR 5/6) and few fine faint light yellowish brown (10YR 6/4) mottles; single grained; loose; 5 percent pebbles; neutral; abrupt wavy boundary.

2C1—28 to 31 inches; brown (10YR 5/3) fine sand; few fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; slight effervescence; neutral; clear wavy boundary.

2C2—31 to 48 inches; pale brown (10YR 6/3) gravelly sand; single grained; loose; about 15 percent pebbles; strong effervescence; mildly alkaline; clear wavy boundary.

2C3—48 to 60 inches; grayish brown (10YR 5/2) gravelly sand; single grained; loose; 30 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum, the depth to the 2C horizon, and the depth to free carbonates range from 20 to 40 inches. Pebble content ranges from 3 to 25 percent in the solum and from 15 to 50 percent in the 2C horizon. Reaction in the solum ranges from medium acid to neutral.

The Ap horizon has value of 2 or 3 and chroma of 1 to 3. Some pedons have an E horizon. The A and E horizons are dominantly loamy sand, but the range includes sandy loam.

The Bt horizon has value of 4 to 6 and chroma of 3 to 6. It is dominantly sandy loam, but the range includes sandy clay loam or gravelly sandy loam. Some pedons do not have a BC horizon.

The 2C horizon has value of 5 to 7 and chroma of 1 to 6. It is gravel, gravelly sand, or stratified sand and gravel. Reaction in the 2C horizon ranges from neutral to moderately alkaline.

Wixom Series

The Wixom series consists of deep, somewhat poorly drained soils on beach ridges, outwash plains, till plains, and till plains modified by glacial lake waters. These soils formed in sandy glaciofluvial deposits and the underlying loamy glacial drift. Permeability is rapid in the upper part of the pedon and moderately slow in the lower part. The slope ranges from 0 to 4 percent.

The Wixom soils are similar to Selfridge soils and are commonly adjacent to Pipestone and Parkhill soils. The Selfridge soils do not have a spodic horizon. The Pipestone soils are sandy throughout the solum and substratum. They and the Wixom soils are in similar positions on the landscape. The Parkhill soils are poorly drained and are lower on the landscape than the Wixom soils.

Typical pedon of Wixom loamy sand, 0 to 4 percent slopes, 1,320 feet north and 765 feet west of the southeast corner of sec. 9, T. 13 N., R. 3 W., Coe Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand; grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; medium acid; abrupt smooth boundary.

E—9 to 13 inches; grayish brown (10YR 5/2) sand, light brownish gray (10YR 6/2) dry; few fine faint dark grayish brown (10YR 4/2) and light brownish gray (10YR 6/2) mottles; single grained; loose; slightly acid; abrupt broken boundary.

Bhs—13 to 18 inches; dark reddish brown (5YR 3/4) sand; common fine prominent strong brown (7.5YR 5/8) mottles; single grained; loose; common weakly cemented chunks of ortstein; medium acid; abrupt broken boundary.

Bs—18 to 25 inches; strong brown (7.5YR 4/6) sand; few fine distinct dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/6) mottles; single grained; loose; few weakly cemented chunks of ortstein; medium acid; clear irregular boundary.

E'—25 to 30 inches; light yellowish brown (10YR 6/4) sand, very pale brown (10YR 7/3) dry; few fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; medium acid; abrupt wavy boundary.

2Bt—30 to 36 inches; yellowish brown (10YR 5/4) loam; many medium distinct (10YR 5/6) mottles; weak fine subangular blocky structure; friable; neutral; abrupt wavy boundary.

2C—36 to 60 inches; yellowish brown (10YR 5/4) loam; few fine prominent brown (7.5YR 5/2) and strong brown (7.5YR 5/8) and common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; common thin streaks of light brownish gray (10YR 6/2) secondary lime; violent effervescence; moderately alkaline.

The depth to the 2Bt horizon ranges from 20 to 40 inches. Pebble content ranges from 0 to 10 percent in the pedon. The sandy part of the solum ranges from strongly acid to neutral.

The Ap horizon has value of 2 to 4 and chroma of 1 or 2. The E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 or 2. The A and E horizons are dominantly loamy sand, but the range includes loamy fine sand, sand, or fine sand.

The Bhs and Bs horizons have hue of 10YR, 7.5YR, or 5YR; value of 3 to 6; and chroma of 2 to 6. They are sand, fine sand, loamy sand, or loamy fine sand.

The E' horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. It is sand, fine sand, loamy sand, or loamy fine sand.

The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is loam, clay loam, or silty clay loam. Reaction in the 2Bt horizon is slightly acid or neutral.

The 2C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 4. It is loam, clay loam, or silty clay loam. Reaction in the 2C horizon is mildly alkaline or moderately alkaline.

Woodbeck Series

The Woodbeck series consists of deep, well drained soils on till plains and moraines. These soils formed in loamy glacial till over sandy deposits. Permeability is moderately slow in the upper part of the pedon and rapid in the lower part. The slope ranges from 1 to 12 percent.

The Woodbeck soils are similar to Perrinton soils and are commonly adjacent to Coloma and Perrinton soils. Unlike Woodbeck soils, the Coloma soils are sandy throughout the solum and substratum. The Perrinton soils have more clay in the substratum. The Coloma and Perrinton soils and the Woodbeck soils are in similar positions on the landscape.

Typical pedon of Woodbeck loam, in an area of Woodbeck-Coloma complex, 6 to 12 percent slopes, 260 feet south and 1,250 feet east of the northwest corner of sec. 26, T. 16 N., R. 4 W., Vernon Township:

Ap—0 to 8 inches; dark brown (10YR 3/3) loam, light gray (10YR 7/2) dry; weak medium granular

structure; friable; slightly acid; abrupt smooth boundary.

B/E—8 to 24 inches; dark brown (7.5YR 4/4) clay loam (Bt) and brown (10YR 5/3) sandy loam, light gray (10YR 7/2) dry (E) as coatings on surfaces of peds and along root channels; moderate medium subangular blocky structure; firm; medium acid; abrupt wavy boundary.

2Bw—24 to 40 inches; dark yellowish brown (10YR 4/4) loamy sand; weak fine granular structure; very friable; slightly acid; clear wavy boundary.

2(E&Bt)—40 to 60 inches; light yellowish brown (10YR 6/4) sand, brownish yellow (10YR 6/6) dry (E); single grained; loose; discontinuous 1/8- to 1/4-inch thick dark brown (7.5YR 4/4) loamy sand lamellae (Bt); single grained; loose; clay bridging between sand grains; slightly acid.

The depth to the sandy 2B horizon ranges from 20 to 40 inches. Pebble content ranges from 0 to 5 percent in the clayey part of the solum and 0 to 30 percent in the sandy part of the solum. The solum ranges from medium acid to neutral.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have a separate E horizon. The E portion of the B/E horizon has value of 5 or 6 and chroma of 2 to 4. The A and E horizons are dominantly loam, but the range includes sandy loam.

Some pedons have a Bt horizon. The B part of the B/E horizon has hue of 7.5YR and 10YR, value of 4 or 5, and chroma of 4 to 6.

The 2B horizon and the B part of the 2(E&Bt) horizon have hue of 7.5YR and 10YR, value of 4 or 5, and chroma of 4 to 6.

The E part of the 2(E&Bt) horizon has value of 4 to 6 and chroma of 4 to 6. It is sand or loamy sand.

Some pedons have a sandy 2C horizon.

Ziegenfuss Series

The Ziegenfuss series consists of deep, poorly drained, slowly permeable soils on till plains, till plains modified by glacial lake waters, and moraines. These soils formed in loamy glacial till. The slope is 0 to 3 percent.

The Ziegenfuss soils are similar to Parkhill soils and are commonly adjacent to Ithaca and Perrinton soils. The Parkhill soils have less clay in the subsoil. The Ithaca soils are somewhat poorly drained, and the Perrinton soils are well drained. The Ithaca and Perrinton soils are higher on the landscape than the Ziegenfuss soils.

Typical pedon of Ziegenfuss loam, 105 feet north and 780 feet west of the southeast corner of sec. 27, T. 15 N., R. 4 W., Isabella Township:

Ap—0 to 9 inches; very dark gray (10YR 3/1) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; less than 2 percent pebbles; slightly acid; abrupt smooth boundary.

Bg1—9 to 15 inches; dark gray (10YR 4/1) clay loam; common fine prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; less than 2 percent pebbles; neutral; clear wavy boundary.

Bg2—15 to 28 inches; gray (10YR 5/1) clay loam; many medium prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; less than 2 percent pebbles; neutral; clear wavy boundary.

Bg3—28 to 34 inches; gray (5Y 5/1) clay loam; many coarse prominent dark gray (10YR 4/1) and many coarse prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; less than 2 percent pebbles; neutral; abrupt wavy boundary.

C—34 to 60 inches; gray (5Y 6/1) clay loam; common fine prominent strong brown (7.5YR 4/6), (5YG 6/1), reddish brown (5YR 5/3) and few medium distinct dark yellowish brown (10YR 4/6) and common fine prominent light gray calcium carbonate streaks; massive; firm; 2 percent pebbles; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 15 to 40 inches. Pebble content ranges from 2 to 10 percent throughout the pedon. The solum ranges from medium acid to mildly alkaline.

The Ap horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 2 or 3; and chroma of 1 or 2. It is dominantly loam, but the range includes silt loam, silty clay loam, and clay loam.

The Bg horizon has hue of 7.5YR, 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is clay loam, silty clay loam, or silty clay.

The C horizon has hue of 10YR, 7.5YR, 2.5Y, or 5Y; value of 4 to 7; and chroma of 1 or 2. It is dominantly clay loam, but the range includes silty clay loam. Reaction in the C horizon is mildly alkaline or moderately alkaline.

Formation of the Soils

The paragraphs that follow describe the factors of soil formation, relate them to the formation of soils in the survey area, and explain the processes of soil formation.

Factors of Soil Formation

Soil formation is determined by the interaction of five major factors: the physical, chemical, and mineral composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the processes of soil formation have acted on the parent material *(3)*.

Climate and plant and animal life are the active forces in soil formation. They slowly change parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and living organisms are modified by relief. The nature of the parent material also affects the kind of soil profile that is formed. In extreme cases, it determines the soil profile entirely. Finally, time is needed to change the parent material into soil. It may be long or short, but some time is required for differentiation of soil horizons. Generally, a long time is required for the formation of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soils that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

Parent Material

Parent material, the unconsolidated mass from which a soil forms, determines the chemical and mineralogical composition of the soil. The parent materials of the soils in Isabella County were deposited by glaciers or by melt waters from glaciers that covered the county 10,000 to 12,000 years ago. Some of these materials have been reworked and redeposited by subsequent action of water and wind. Although the parent materials in Isabella County are of common glacial origin, their properties vary greatly, sometimes within a small area, depending on how the materials were deposited (fig. 17). The dominant parent materials in Isabella County were deposited as glacial till, outwash material, alluvium, and organic material.

Glacial till is material that was deposited directly by glaciers with a minimum of water action. It is a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Isabella County generally is calcareous. Its texture is sandy loam, loam, silty clay loam, or clay loam. The soils that have formed from this till typically are moderately fine textured and have a well developed subsoil.

Outwash material has been deposited by running water from melting glaciers. The size of the particles varies according to the speed of the stream that carried them. As the speed of the stream decreases, the coarser particles are deposited first. Only the finer particles, such as the very fine sand, silt, and clay, can be carried by slowly moving water. Outwash deposits generally consist of layers of particles of similar size, such as sand, gravel, and other coarse particles. The Ormas soils formed in deposits of outwash material.

Alluvium is material that has recently been deposited by floodwater from streams. The material varies in texture depending on the speed of the water from which the alluvium was deposited. The alluvium deposited along a swift stream, such as the Pine River, is coarser than that deposited along a slow, sluggish stream, such as the Chippewa River. The Cohoctah, Algansee, and Shoals soils are alluvial soils.

Organic material is made up of accumulated plant remains. After the glaciers receded, water was left standing in depressions in outwash plains, flood plains, moraines, and till plains. Because of the wetness, the grasses, sedges, and water-tolerant plants that grew around the edges of these depressions did not decompose quickly after they died. Eventually, the plant residue filled the depressions and decomposed to form muck. Pinnebog soils formed in organic material.

Plants and Animal Life

Green plants have been the principal organisms influencing the soils in Isabella County. Bacteria, fungi, earthworms, and the activities of man have also been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on the soil depends on the kinds of plants that grew on the soil. The remains of these plants accumulated on the surface, decayed, and eventually became organic matter. The roots of the

Figure 17.—Most fields contain a variety of soils. In this field, the light colored area is well drained Metea loamy sand, and the adjacent darker area is somewhat poorly drained Selfridge sand.

plants create channels through which water moves into the soil. They also add organic matter as they decay. Bacteria in the soil help to break down the organic matter so that it can be used by growing plants.

The original vegetation in Isabella County was a mixture of deciduous and coniferous forest. Differences in natural soil drainage and minor changes in parent material affected the composition of the forest species.

The well drained upland soils, such as Perrinton, Spinks, and Coloma soils, were covered mainly by sugar maple and white pine. The wet soils were covered mainly by elm, ash, aspen, and white-cedar.

Climate

Climate determines the kind of plant and animal life on and in the soil. It also determines the amount of water available for weathering of minerals and for the transporting of soil material. Climate influences temperature, thus affecting the rate of chemical reaction in the soil.

The climate in Isabella County, presumably similar to that in which the soil formed, is cool and humid. It is uniform throughout the county. Differences in climate account for only minor differences in the soils in Isabella County.

Relief

Relief, or topography, affects the natural drainage of soils, the rate of soil erosion, the kinds of plants that grow, and the soil temperature. In Isabella County, the slopes range from 0 to 45 percent. Runoff is most rapid on the steeper slopes. Water temporarily ponds in low areas.

The soils in Isabella County range from excessively drained on the ridgetops to very poorly drained in the depressions. By affecting the soil's aeration, drainage partly determines the color of the soil. Generally, water and air move freely through soils that are well drained and more slowly through soils that are very poorly

drained. In well aerated soils, the iron and aluminum compounds are brightly colored and oxidized. Poorly aerated soils are dull gray and mottled. Ziegenfuss soils, which formed in similar parent material, differ in color because of drainage characteristics. The well drained and well aerated Perrinton soils are brown and yellowish brown; the poorly drained and poorly aerated Ziegenfuss soils are gray and contain mottles and streaks.

Time

In general, a long time is required for the development of distinct horizons from parent material. The differences in the length of time that parent material has been in place is commonly reflected in the degree of development of the soil profile. Some soils develop rapidly and others develop slowly.

The soils in Isabella County range in age from young to mature. The glacial deposits that provide the parent material for Isabella County have been exposed to soil forming factors long enough for distinct horizons to develop. The recent alluvial sediments that provide the parent material for younger soils, however, have not been in place long enough for distinct horizons to develop.

The Cohoctah soils, which formed in alluvial material, are an example of young soils. The mature Londo soils are old enough for distinct horizons to have formed and for lime to have moved from the upper to the lower layers of the soil.

Processes of Soil Formation

The processes responsible for the development of the soil from the unconsolidated parent material are referred to collectively as soil genesis. The physical, chemical, and biological properties of the horizons are known as soil morphology.

Several processes were involved in the development of horizons in the soils of Isabella County: (1) the accumulation of organic matter, (2) the leaching of lime and other bases, (3) the reduction and transfer of iron, and (4) the formation and translocation of silicate clay minerals. In most of the soils in Isabella County, more than one of these processes have been active in the development of horizons.

As organic matter accumulates on the surface of a soil, the uppermost, or A horizon is formed. If the soil is plowed, the A horizon is mixed into a plow layer, or Ap horizon. In the soils in Isabella County, the organic matter content of the surface layer ranges from high to low. The Cohoctah soils, for example, have a high content and the Plainfield soils a low content of organic matter in the surface layer.

In most of the soils of Isabella County, leaching of carbonates and other bases from the surface layer has occurred. The leaching of bases generally precedes the translocation of silicate clay minerals. Several of the soils in Isabella County are moderately to strongly leached. For example, Pipestone and Spinks soils are leached of carbonates to a depth of more than 60 inches, whereas Ithaca soils are leached to a depth of 24 inches. This difference in the depth of leaching is a result of differences in time, relief, and parent material.

The reduction and transfer of iron, a process called gleying, is evident in the somewhat poorly drained, poorly drained, and very poorly drained soils. A gray subsoil indicates the reduction and loss of iron. The Parkhill soils, for example, are strongly gleyed.

Translocation of clay minerals contributes to horizon development. The eluviated, or leached, E horizon typically has a platy structure, is lower in clay content, and is lighter in color than the illuviated B horizon. The B horizon typically has an accumulation of clay or clay films in pores and on the faces of peds. Soils at this stage of formation probably were leached of carbonates and soluble salts to a considerable extent before translocation of silicate clays occurred. The leaching of bases and the translocation of silicate clays are among the most important processes in causing soil horizons to become differentiated. Guelph soils are an example of soils in which translocated silicate clay in the form of clay films has accumulated in the B horizon.

In some soils, iron, aluminum, and humus have moved from the A horizon to the B horizon. The color of the B horizon in such soils is dark brown. Covert, Pipestone, and Wixom soils are examples of soils in which translocated iron, aluminum, and humus have accumulated in the B horizon.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded and 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. Includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-80 at Mt. Pleasant, Michigan]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	28.5	13.0	20.8	50	-13	0	1.37	0.6	2.0	4	10.0
February---	31.6	13.7	22.7	50	-13	0	1.12	.5	1.7	3	6.8
March------	41.3	22.6	31.9	69	-2	5	1.99	1.1	2.7	5	6.4
April------	57.1	34.5	45.8	81	16	70	3.19	2.1	4.2	7	1.9
May--------	69.7	44.5	57.1	88	27	260	2.85	1.5	4.0	6	Trace
June-------	79.1	54.1	66.6	94	37	506	3.20	1.7	4.5	6	0
July-------	83.2	58.3	70.7	94	44	651	3.22	1.7	4.5	6	0
August-----	81.2	56.8	69.0	94	41	596	3.57	1.9	5.1	6	0
September--	73.2	49.4	61.3	91	31	353	2.95	1.3	4.4	6	Trace
October----	61.5	39.8	50.6	83	22	128	2.60	1.1	3.9	6	.3
November---	46.2	30.1	38.1	70	8	14	2.33	1.6	3.0	5	3.0
December---	33.5	19.4	26.4	58	-5	0	1.86	.8	2.8	5	7.7
Year-----	57.2	36.3	46.8	96	-16	2,583	30.25	25.8	34.6	65	36.1

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1950-79 at Mt. Pleasant, Michigan]

Probability	Minimum temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 24	May 15	May 24
2 years in 10 later than--	April 20	May 9	May 20
5 years in 10 later than--	April 13	April 29	May 12
First freezing temperature in fall:			
1 year in 10 earlier than--	October 15	October 3	September 18
2 years in 10 earlier than--	October 20	October 8	September 22
5 years in 10 earlier than--	October 31	October 19	October 2

TABLE 3.--GROWING SEASON LENGTH

[Recorded in the period 1950-79 at Mt. Pleasant, Michigan]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	183	150	124
8 years in 10	189	156	130
5 years in 10	201	172	143
2 years in 10	213	186	155
1 year in 10	219	194	162

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
10	Pinnebog muck	12,425	3.4
11B	Spinks sand, 0 to 6 percent slopes	9,600	2.6
11C	Spinks sand, 6 to 12 percent slopes	3,735	1.0
11D	Spinks sand, 12 to 18 percent slopes	1,120	0.3
12B	Coloma sand, 0 to 6 percent slopes	14,495	4.0
12C	Coloma sand, 6 to 12 percent slopes	6,085	1.7
12D	Coloma sand, 12 to 18 percent slopes	2,475	0.7
12E	Coloma sand, 18 to 25 percent slopes	1,850	0.5
12F	Coloma sand, 25 to 45 percent slopes	1,750	0.5
14B	Tekenink loamy fine sand, 2 to 6 percent slopes	1,875	0.5
14C	Tekenink loamy fine sand, 6 to 12 percent slopes	455	0.1
15B	Plainfield sand, 0 to 6 percent slopes	9,750	2.7
15C	Plainfield sand, 6 to 12 percent slopes	2,230	0.6
15D	Plainfield sand, 12 to 18 percent slopes	785	0.2
16A	Wasepi loamy sand, 0 to 3 percent slopes	4,425	1.2
17	Cohoctah fine sandy loam, frequently flooded	4,720	1.3
18B	Covert sand, 0 to 4 percent slopes	2,610	0.7
19	Gilford fine sandy loam	3,640	1.0
20A	Pipestone sand, 0 to 3 percent slopes	21,075	5.8
21	Kingsville loamy sand	10,710	2.9
22B	Perrinton loam, 2 to 6 percent slopes	19,585	5.4
22C	Perrinton loam, 6 to 12 percent slopes	4,655	1.3
22D	Perrinton loam, 12 to 18 percent slopes	700	0.2
23B	Ithaca loam, 0 to 4 percent slopes	26,810	7.3
24	Ziegenfuss loam	7,730	2.1
25B	Wixom loamy sand, 0 to 4 percent slopes	4,090	1.1
26A	Metamora fine sandy loam, 0 to 3 percent slopes	2,645	0.7
27	Corunna sandy loam	4,935	1.3
29A	Minoa loamy fine sand, 0 to 3 percent slopes	1,575	0.4
30	Lamson fine sandy loam	1,195	0.3
33A	Thetford loamy sand, 0 to 3 percent slopes	5,115	1.4
34	Belleville loamy sand	2,830	0.8
35B	Metea loamy sand, 1 to 6 percent slopes	4,185	1.1
36	Adrian muck	10,760	2.9
39A	Londo loam, 0 to 3 percent slopes	33,080	9.0
40	Parkhill loam	18,520	5.1
42	Edwards muck	2,205	0.6
45B	Guelph-Londo loams, 1 to 6 percent slopes	915	0.2
47	Algansee loamy sand	860	0.2
49B	Marlette loam, 2 to 6 percent slopes	8,395	2.3
49C	Marlette loam, 6 to 12 percent slopes	3,110	0.8
49D	Marlette loam, 12 to 20 percent slopes	525	0.1
50A	Mecosta sand, 0 to 3 percent slopes	1,755	0.5
51	Pits, gravel	435	0.1
52	Udorthents, loamy	600	0.2
53	Udipsamments, nearly level	1,610	0.4
54	Histosols and Aquents, ponded	1,465	0.4
55A	Urban land-Mecosta complex, 0 to 3 percent slopes	940	0.3
56A	Urban land-Thetford complex, 0 to 3 percent slopes	1,010	0.3
57A	Urban land-Londo complex, 0 to 3 percent slopes	715	0.2
60B	Guelph loam, 2 to 6 percent slopes	7,970	2.2
60C	Guelph loam, 6 to 12 percent slopes	2,095	0.6
61A	Selfridge sand, 0 to 3 percent slopes	13,430	3.7
62B	Ormas sand, 0 to 6 percent slopes	5,485	1.5
62C	Ormas sand, 6 to 12 percent slopes	1,035	0.3
62D	Ormas sand, 12 to 18 percent slopes	385	0.1
63B	Remus-Spinks complex, 1 to 6 percent slopes	17,970	4.9
63C	Remus-Spinks complex, 6 to 12 percent slopes	9,595	2.6
63D	Remus-Spinks complex, 12 to 18 percent slopes	2,480	0.7
63E	Remus-Spinks complex, 18 to 35 percent slopes	470	0.1
65B	Arkport loamy fine sand, 1 to 6 percent slopes	1,310	0.4
65C	Arkport loamy fine sand, 6 to 12 percent slopes	270	0.1
66B	Woodbeck-Coloma complex, 1 to 6 percent slopes	1,115	0.3
66C	Woodbeck-Coloma complex, 6 to 12 percent slopes	520	0.1
67B	Remus sandy loam, 1 to 6 percent slopes	5,315	1.4
67C	Remus sandy loam, 6 to 12 percent slopes	1,795	0.5
67D	Remus sandy loam, 12 to 18 percent slopes	410	0.1
70B	Ithaca-Selfridge complex, 0 to 4 percent slopes	1,560	0.4
71	Cohoctah fine sandy loam, occasionally flooded	780	0.2
74	Shoals silt loam	985	0.3
	Water	2,985	0.8
	Total	366,720	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Corn silage	Winter wheat	Soybeans	Oats	Grass-legume hay
	Bu	Tons	Bu	Bu	Bu	Tons
10-----Pinnebog	---	---	---	---	---	---
11B-----Spinks	75	13	30	25	60	3.0
11C-----Spinks	68	12	30	23	55	2.4
11D-----Spinks	60	12	24	20	50	1.8
12B-----Coloma	50	10	25	20	45	2.8
12C-----Coloma	45	9	23	18	40	2.5
12D-----Coloma	---	---	---	---	---	---
12E-----Coloma	---	---	---	---	---	---
12F. Coloma						
14B-----Tekenink	90	15	40	35	55	4.0
14C-----Tekenink	80	14	35	32	45	3.6
15B, 15C-----Plainfield	50	---	---	---	45	3.0
15D-----Plainfield	---	---	---	---	---	---
16A-----Wasepi	80	13	35	32	65	3.4
17-----Cohoctah	---	---	---	---	---	3.4
18B-----Covert	50	10	25	---	45	3.0
19-----Gilford	90	16	45	30	75	3.8
20A-----Pipestone	60	12	30	---	60	3.5
21-----Kingsville	75	12	40	25	60	3.8
22B-----Perrinton	100	17	55	35	80	5.0
22C-----Perrinton	95	16	52	30	75	4.2
22D-----Perrinton	90	14	48	24	70	3.4

Soil name and map symbol	Corn	Corn silage	Winter wheat	Soybeans	Oats	Grass-legume hay
	Bu	Tons	Bu	Bu	Bu	Tons
23B------------------------ Ithaca	115	18	55	38	85	5.5
24------------------------- Ziegenfuss	125	19	60	42	100	5.8
25B------------------------ Wixom	95	16	45	35	80	4.2
26A------------------------ Metamora	115	18	60	40	95	4.8
27------------------------- Corunna	120	18	65	40	100	5.0
29A------------------------ Minoa	95	19	52	30	80	3.5
30------------------------- Lamson	75	15	52	30	50	3.5
33A------------------------ Thetford	80	12	35	30	60	3.8
34------------------------- Belleville	105	17	50	35	85	4.2
35B------------------------ Metea	95	16	42	30	75	4.0
36------------------------- Adrian	---	---	---	---	---	---
39A------------------------ Londo	120	13	60	45	100	5.0
40------------------------- Parkhill	125	20	65	40	110	5.5
42------------------------- Edwards	---	---	---	---	---	---
45B------------------------ Guelph-Londo	114	18	53	39	94	4.9
47------------------------- Algansee	80	13	35	35	65	3.5
49B------------------------ Marlette	110	18	60	35	90	4.8
49C------------------------ Marlette	100	14	56	33	90	4.5
49D------------------------ Marlette	85	13	48	---	75	3.8
50A------------------------ Mecosta	50	8	20	---	40	2.7
51*. Pits						
52*. Udorthents						
53*. Udipsamments						

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Corn	Corn silage	Winter wheat	Soybeans	Oats	Grass-legume hay
	Bu	Tons	Bu	Bu	Bu	Tons
54 Histosols and Aquents	---	---	---	---	---	---
55A* Urban land-Mecosta	---	---	---	---	---	---
56A* Urban land-Thetford	---	---	---	---	---	---
57A* Urban land-Londo	---	---	---	---	---	---
60B Guelph	110	17	60	35	90	4.8
60C Guelph	90	16	50	30	85	4.8
61A Selfridge	100	16	45	35	80	3.0
62B Ormas	75	13	30	25	60	3.5
62C Ormas	70	12	28	23	55	3.2
62D Ormas	65	11	25	---	50	2.9
63B Remus-Spinks	81	1	35	28	68	3.4
63C Remus-Spinks	75	12	34	23	63	3.1
63D Remus-Spinks	---	---	30	---	58	2.6
63E Remus-Spinks	---	---	---	---	---	---
65B, 65C Arkport	90	18	45	35	70	3.5
66B, 66C Woodbeck-Coloma	88	14	45	35	76	3.7
67B Remus	95	16	45	30	80	3.7
67C Remus	90	15	42	26	75	3.5
67D Remus	85	14	37	22	70	3.3
70B Ithaca-Selfridge	94	14	43	35	78	3.7
71 Cohoctah	125	20	60	45	110	4.5
74 Shoals	130	22	52	46	100	4.3

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	---	---	---	---
II	160,715	91,260	69,455	---
III	84,475	30,415	33,515	20,545
IV	72,100	5,235	34,395	32,470
V	30,110	---	30,110	---
VI	5,175	470	---	4,705
VII	4,385	---	---	4,385
VIII	1,465	---	1,465	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
10------------------ Pinnebog	3w	Slight	Severe	Severe	Severe	Red maple-----------	56	
						Tamarack------------	45	
						Quaking aspen-------	60	
						Silver maple--------	82	
						Green ash-----------	56	
11B, 11C, 11D------ Spinks	2s	Slight	Slight	Moderate	Slight	Northern red oak----	66	Red pine, eastern white pine, imperial Carolina poplar.
						White oak-----------	---	
						Black oak-----------	---	
						Black cherry--------	---	
12B, 12C, 12D------ Coloma	3s	Slight	Slight	Severe	Slight	Northern pin oak----	53	Red pine, eastern white pine, jack pine.
						Jack pine-----------	---	
						Black oak-----------	---	
						White oak-----------	---	
						Red pine------------	---	
						Eastern white pine--	---	
12E, 12F----------- Coloma	3r	Moderate	Moderate	Severe	Slight	Northern pin oak----	53	Red pine, eastern white pine, jack pine.
						Jack pine-----------	---	
						Black oak-----------	---	
						White oak-----------	---	
						Red pine------------	---	
						Eastern white pine--	---	
14B, 14C----------- Tekenink	3s	Slight	Slight	Moderate	Slight	Northern red oak----	66	Black walnut, red pine, eastern white pine, yellow-poplar.
						Black cherry--------	---	
						White ash-----------	---	
						American basswood---	---	
						American beech------	---	
						Sugar maple---------	---	
15B, 15C, 15D------ Plainfield	2s	Slight	Moderate	Moderate	Slight	Eastern white pine--	58	Red pine, eastern white pine, jack pine.
						Red pine------------	55	
						Jack pine-----------	49	
						Northern pin oak----	48	
						Black oak-----------	---	
						White oak-----------	---	
16A---------------- Wasepi	3w	Slight	Moderate	Slight	Moderate	Quaking aspen-------	60	White spruce, eastern white pine, Norway spruce, imperial Carolina poplar.
						Red maple-----------	---	
						Silver maple--------	---	
						Paper birch---------	---	
17----------------- Cohoctah	3w	Slight	Severe	Severe	Severe	Red maple-----------	56	Eastern white pine, imperial Carolina poplar, northern white-cedar.
						Eastern cottonwood--	---	
						Silver maple--------	---	
						White ash-----------	---	
						Swamp white oak-----	---	
						American sycamore---	---	
						Pin oak-------------	---	
						Bitternut hickory---	---	
18B---------------- Covert	2s	Slight	Slight	Severe	Slight	Northern red oak----	67	Red pine, black walnut, eastern white pine.
						Red maple-----------	66	
						Black cherry--------	---	
						Eastern cottonwood--	---	
						American basswood---	---	
						White oak-----------	---	
						Quaking aspen-------	---	
						American beech------	---	
						Eastern white pine--	---	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
19 Gilford	3w	Slight	Severe	Severe	Severe	Red maple	56	Eastern white pine, white spruce.
						Silver maple	---	
						American basswood	---	
						Bur oak	---	
						White ash	---	
						Swamp white oak	---	
20A Pipestone	2w	Slight	Moderate	Slight	Moderate	Red maple	65	White spruce, eastern white pine.
						White ash	---	
						Eastern cottonwood	---	
						Bitternut hickory	---	
						Hackberry	---	
						American basswood	56	
						Eastern white pine	64	
21 Kingsville	2w	Slight	Severe	Severe	Severe	Green ash	65	Eastern white pine, white spruce.
						Black cherry	---	
						Eastern cottonwood	---	
						Red maple	---	
						Swamp white oak	---	
22B, 22C, 22D Perrinton	2a	Slight	Slight	Slight	Slight	Northern red oak	65	White spruce, eastern white pine, northern red oak.
						Sugar maple	---	
						Red maple	---	
						White ash	---	
						American basswood	---	
						Bitternut hickory	---	
						Shagbark hickory	---	
23B Ithaca	2w	Slight	Moderate	Slight	Moderate	Northern red oak	65	White spruce, eastern white pine, imperial Carolina poplar, northern red oak.
						Sugar maple	---	
						American basswood	---	
						White ash	---	
						Northern pin oak	---	
						Shagbark hickory	---	
						Red maple	---	
						Bitternut hickory	---	
24 Ziegenfuss	2w	Slight	Severe	Moderate	Moderate	Red maple	66	Eastern white pine, white spruce, Norway spruce, imperial Carolina poplar.
						White ash	---	
						American basswood	---	
						American sycamore	---	
						Swamp white oak	---	
						Green ash	---	
						Eastern cottonwood	---	
						Eastern hemlock	---	
25B Wixom	2w	Slight	Moderate	Slight	Moderate	Quaking aspen	70	Eastern white pine, white spruce.
						American beech	---	
						Northern red oak	---	
						Red maple	66	
						American basswood	---	
26A Metamora	2w	Slight	Moderate	Slight	Moderate	Northern red oak	62	White spruce, eastern white pine, northern white-cedar.
						White ash	---	
						Bitternut hickory	---	
						Green ash	---	
						Shagbark hickory	---	
						American basswood	---	
						Sugar maple	---	
						Red maple	---	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
27------------------ Corunna	3w	Slight	Severe	Moderate	Moderate	Silver maple---------	82	Eastern white pine, white spruce.
						Red maple------------	56	
						White ash------------	---	
						American basswood----	---	
						American sycamore----	---	
						Pin oak--------------	---	
						Swamp white oak------	---	
29A----------------- Minoa	2w	Slight	Moderate	Moderate	Moderate	Sugar maple----------	60	Eastern white pine, European larch, white spruce.
						White ash------------	69	
						Northern red oak-----	70	
						Eastern hemlock------	65	
30------------------ Lamson	3w	Slight	Severe	Severe	Severe	Eastern white pine---	55	Northern white-cedar, eastern white pine.
						Red maple------------	55	
						Swamp white oak------	---	
33A----------------- Thetford	2w	Slight	Moderate	Slight	Moderate	Red maple------------	61	White spruce, eastern white pine, imperial Carolina poplar.
						White ash------------	---	
						Quaking aspen--------	---	
						Eastern cottonwood---	---	
						Northern red oak-----	---	
						Swamp white oak------	---	
						Bitternut hickory----	---	
34------------------ Belleville	5w	Slight	Severe	Moderate	Moderate	Silver maple---------	64	
						Red maple------------	---	
						White ash------------	---	
						Pin oak--------------	---	
						Swamp white oak------	---	
35B----------------- Metea	2s	Slight	Moderate	Moderate	Slight	Northern red oak-----	66	Eastern white pine, red pine, white spruce, black walnut, European alder, Norway spruce.
						White oak------------	---	
						Sugar maple----------	---	
						American basswood----	---	
						Black cherry---------	---	
						Black walnut---------	---	
						Shagbark hickory-----	---	
36------------------ Adrian	3w	Slight	Severe	Severe	Severe	Silver maple---------	78	
						Red maple------------	53	
						White ash------------	69	
						Quaking aspen--------	60	
						Tamarack-------------	45	
						Green ash------------	69	
39A----------------- Londo	2w	Slight	Moderate	Slight	Moderate	Green ash------------	66	White spruce, eastern white pine, green ash, northern red oak.
						Northern red oak-----	66	
						Black oak------------	---	
						Red maple------------	66	
						American basswood----	66	
						Eastern cottonwood---	101	
						White ash------------	65	
40------------------ Parkhill	2w	Slight	Severe	Severe	Moderate	Red maple------------	66	
						Silver maple---------	91	
						Pin oak--------------	---	
						White ash------------	66	
						American basswood----	66	
						Swamp white oak------	---	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Management concerns: Equip-ment limita-tion	Management concerns: Seedling mortal-ity	Management concerns: Wind-throw hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
42------------------ Edwards	3w	Slight	Severe	Severe	Severe	Red maple----------- White ash----------- Green ash----------- Tamarack------------ Swamp white oak----- Silver maple---------	56 --- --- --- --- ---	
45B*: Guelph-------------	2a	Slight	Slight	Slight	Slight	Sugar maple--------- Northern red oak---- Eastern white pine-- Black walnut-------- White oak----------- Black cherry-------- Red pine------------	61 --- --- --- --- --- ---	White spruce, eastern white pine, black walnut, yellow-poplar, red pine, imperial Carolina poplar.
Londo--------------	2w	Slight	Moderate	Slight	Moderate	Green ash----------- Northern red oak---- Black oak----------- Red maple----------- American basswood--- Eastern cottonwood-- White ash-----------	66 66 --- 66 66 101 65	White spruce, eastern white pine.
47------------------ Algansee	3w	Slight	Moderate	Slight	Moderate	Quaking aspen------- Silver maple-------- Swamp white oak----- White ash----------- Red maple----------- American sycamore--- Green ash-----------	60 78 --- --- 56 --- ---	White spruce, imperial Carolina poplar, eastern white pine.
49B, 49C, 49D------ Marlette	2a	Slight	Slight	Slight	Slight	Sugar maple--------- Northern red oak---- White ash----------- Black walnut-------- American basswood--- Black cherry-------- White oak-----------	65 69 --- --- --- --- ---	Black walnut, eastern white pine, red pine.
50A----------------- Mecosta	3s	Slight	Slight	Severe	Slight	Red pine------------ White oak----------- Northern red oak---- Quaking aspen------- Black oak-----------	55 --- --- --- ---	Red pine, eastern white pine, jack pine.
60B, 60C------------ Guelph	2a	Slight	Slight	Slight	Slight	Sugar maple--------- Northern red oak---- Eastern white pine-- Black walnut-------- White oak----------- Black cherry-------- Red pine------------	61 --- --- --- --- --- ---	White spruce, eastern white pine, black walnut, yellow-poplar, red pine, imperial Carolina poplar.
61A----------------- Selfridge	2w	Slight	Moderate	Severe	Moderate	Quaking aspen------- American beech------ Northern red oak---- Red maple----------- Sugar maple--------- Black cherry-------- American basswood---	70 --- --- --- --- --- ---	Eastern white pine, Norway spruce, imperial Carolina poplar.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
62B, 62C, 62C------ Ormas	2s	Slight	Slight	Moderate	Slight	Black oak-----------	65	Black walnut, red pine, eastern white, pine, yellow-poplar.
						White oak-----------	66	
						Bigtooth aspen------	75	
						Black cherry--------	---	
						Yellow-poplar-------	---	
63B*, 63C*, 63D*:								
Remus-------------	2a	Slight	Slight	Slight	Slight	Sugar maple---------	61	White spruce, eastern white pine, red pine.
						Northern red oak----	---	
						American basswood---	---	
						Eastern hemlock-----	---	
						Quaking aspen-------	---	
						White ash-----------	---	
						White oak-----------	---	
						Red maple-----------	---	
						Black cherry--------	---	
						American beech------	---	
						Paper birch---------	---	
						Bitternut hickory---	---	
Spinks------------	2s	Slight	Slight	Moderate	Slight	Northern red oak----	66	Red pine, eastern white pine, imperial Carolina poplar.
						White oak-----------	---	
						Black oak-----------	---	
						Black cherry--------	---	
63E*:								
Remus-------------	2r	Moderate	Moderate	Slight	Slight	Sugar maple---------	61	White spruce, eastern white pine, red pine.
						Northern red oak----	---	
						American basswood---	---	
						Eastern hemlock-----	---	
						Quaking aspen-------	---	
						White ash-----------	---	
						White oak-----------	---	
						Red maple-----------	---	
						Black cherry--------	---	
						American beech------	---	
						Paper birch---------	---	
						Bitternut hickory---	---	
Spinks------------	2r	Moderate	Moderate	Moderate	Slight	Northern red oak----	66	Red pine, eastern white pine, imperial Carolina poplar.
						White oak-----------	---	
						Black oak-----------	---	
						Black cherry--------	---	
65B, 65C----------- Arkport	2a	Slight	Slight	Slight	Slight	Sugar maple---------	61	Norway spruce, red pine, eastern white pine.
						Red pine------------	---	
						Eastern white pine--	---	
66B*, 66C*:								
Woodbeck----------	2a	Slight	Slight	Slight	Slight	Sugar maple---------	61	Eastern white pine, white spruce, imperial Carolina poplar.
						American beech------	---	
						Eastern white pine--	---	
						Northern red oak----	---	
						Shagbark hickory----	---	
						Red maple-----------	---	
Coloma------------	3s	Slight	Slight	Severe	Slight	Northern pin oak----	53	Red pine, eastern white pine, jack pine.
						Jack pine-----------	---	
						Black oak-----------	---	
						White oak-----------	---	
						Red pine------------	---	
						Eastern white pine--	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Common trees	Site index	
67B, 67C, 67D------ Remus	2a	Slight	Slight	Slight	Slight	Sugar maple--------- Northern red oak---- American basswood--- Eastern hemlock----- Quaking aspen------- White ash----------- White oak----------- Red maple----------- Black cherry-------- American beech------ Paper birch--------- Bitternut hickory---	61 --- --- --- --- --- --- --- --- --- --- ---	White spruce, eastern white pine, red pine.
70B*: Ithaca------------	2w	Slight	Moderate	Slight	Moderate	Northern red oak---- Sugar maple--------- American basswood--- White ash----------- Northern pin oak---- Shagbark hickory---- Red maple----------- Bitternut hickory---	65 --- --- --- --- --- --- ---	White spruce, eastern white pine, northern white-cedar, imperial Carolina poplar.
Selfridge---------	2w	Slight	Moderate	Severe	Moderate	Quaking aspen------- American beech------ Northern red oak---- Red maple----------- Sugar maple--------- Black cherry-------- American basswood---	70 --- --- --- --- --- ---	Eastern white pine, imperial Carolina poplar.
71----------------- Cohoctah	3w	Slight	Severe	Severe	Severe	Red maple----------- Eastern cottonwood-- Silver maple-------- White ash----------- Swamp white oak----- American sycamore--- Bitternut hickory---	56 --- --- --- --- --- ---	Eastern white pine, imperial Carolina poplar, northern white-cedar.
74----------------- Shoals	2w	Slight	Moderate	Moderate	Moderate	Northern red oak---- White ash----------- Red maple----------- American basswood--- Eastern cottonwood--	65 --- --- --- ---	Eastern white pine, white spruce, yellow-poplar.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
10. Pinnebog					
11B, 11C, 11D. Spinks	Manyflower cotoneaster.	American cranberrybush, silky dogwood, eastern redcedar, lilac, Siberian peashrub.	White spruce	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
12B, 12C, 12D, 12E, 12F. Coloma	Manyflower cotoneaster.	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood.	White spruce, northern white-cedar.	Eastern white pine, red pine, jack pine, Norway spruce.	Imperial Carolina poplar.
14B, 14C. Tekenink	---	Amur privet, nannyberry viburnum, lilac, silky dogwood, American cranberrybush.	White spruce, northern white-cedar.	Eastern white pine, red pine, Norway spruce, green ash.	Imperial Carolina poplar.
15B, 15C, 15D. Plainfield	Cotoneaster	Siberian peashrub, eastern redcedar, Amur privet, lilac, Amur honeysuckle.	Manchurian crabapple.	Eastern white pine, red pine.	---
16A. Wasepi	---	Amur maple, Amur privet, silky dogwood, American cranberrybush, lilac.	Northern white-cedar, white spruce.	Eastern white pine, green ash, Norway spruce, red maple.	Imperial Carolina poplar.
17. Cohoctah	---	Amur privet, American cranberrybush, lilac, nannyberry viburnum, silky dogwood.	Northern white-cedar, Manchurian crabapple, white spruce.	Green ash, eastern white pine.	Imperial Carolian poplar.
18B. Covert	---	Lilac, American cranberrybush, Amur privet, Amur maple, silky dogwood.	White spruce, northern white-cedar.	Red maple, eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
19. Gilford	---	Silky dogwood, American cranberrybush, Amur privet, lilac, nannyberry viburnum.	Northern white-cedar, white spruce, Manchurian crabapple.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
20A. Pipestone	---	Lilac, Amur maple, Amur privet, silky dogwood, American cranberrybush.	Northern white-cedar, white spruce.	Red maple, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
21----------------- Kingsville	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
22B, 22C, 22D----- Perrinton	---	Amur maple, lilac, silky dogwood, American cranberrybush.	White spruce, northern white-cedar, Manchurian crabapple, nannyberry viburnum.	Eastern white pine, green ash, Norway spruce.	Imperial Carolina poplar.
23B--------------- Ithaca	---	Silky dogwood, Amur maple, lilac, American cranberrybush, Amur privet.	Northern white-cedar, white spruce.	Eastern white pine, green ash, Norway spruce, red maple.	Imperial Carolina poplar.
24---------------- Ziegenfuss	---	Silky dogwood, lilac, American cranberrybush, nannyberry viburnum, Amur privet.	Northern white-cedar, Manchurian crabapple, white spruce.	Green ash, Norway spruce, eastern white pine.	Imperial Carolina poplar.
25B--------------- Wixom	---	Silky dogwood, lilac, Amur privet, American cranberrybush, Amur maple.	White spruce, northern white-cedar.	Eastern white pine, Norway spruce, green ash, red maple.	Imperial Carolina poplar.
26A--------------- Metamora	---	Silky dogwood, American cranberrybush, lilac, Amur maple, Amur privet.	Northern white-cedar, white spruce.	Eastern white pine, Norway spruce, green ash, red maple.	Imperial Carolina poplar.
27---------------- Corunna	---	Silky dogwood, American cranberrybush, lilac, nannyberry viburnum, Amur privet.	Northern white-cedar, Manchurian crabapple, white spruce.	Green ash, eastern white pine, Norway spruce.	Imperial Carolina poplar.
29A--------------- Minoa	Vanhoutte spirea	American crawberrybush, Tatarian honey-suckle, silky dogwood, lilac.	White spruce, northern white cedar.	Eastern white green ash, red maple.	---
30---------------- Lamson	Vanhoutte spirea	American cranberrybush, Tatarian honeysuckle, Amur privet, silky dogwood.	Northern white-cedar, white spruce.	Eastern white pine, green ash.	---
33A--------------- Thetford	---	Silky dogwood, lilac, Amur maple, American cranberrybush, Amur privet.	White spruce, northern white-cedar.	Norway spruce, eastern white pine, red maple, green ash.	Imperial Carolina poplar.
34---------------- Belleville	---	Silky dogwood, Amur privet, nannyberry viburnum, lilac, American cranberrybush.	White spruce, northern white-cedar, Manchurian crabapple.	Eastern white pine, green ash, Norway spruce.	Imperial Carolina poplar.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
35B. Metea	---	Amur privet, silky dogwood, American cranberrybush, nannyberry viburnum, lilac.	White spruce, northern white-cedar.	Eastern white pine, red pine, green ash, Norway spruce.	Imperial Carolina poplar.
36. Adrian					
39A. Londo	---	Amur privet, silky dogwood, lilac, American cranberrybush, Amur maple.	White spruce, northern white-cedar.	Norway spruce, green ash, red maple, eastern white pine.	Imperial Carolina poplar.
40. Parkhill	---	Silky dogwood, Amur privet, lilac, nannyberry viburnum, American cranberrybush.	Northern white-cedar, white spruce, Manchurian crabapple.	Eastern white pine, green ash, Norway spruce.	Imperial Carolina poplar.
42. Edwards	---	Amur privet, nannyberry viburnum, American cranberrybush, silky dogwood, common ninebark, Amur maple.	Manchurian crabapple, northern white-cedar.	White spruce, green ash, black willow.	Imperial Carolina poplar.
45B*:					
Guelph	---	American cranberrybush, lilac, silky dogwood.	White spruce, Manchurian crabapple, Amur maple, nannyberry viburnum, northern white-cedar.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
Londo	---	Amur privet, silky dogwood, lilac, American cranberrybush, Amur maple.	White spruce, northern white-cedar.	Norway spruce, green ash, red maple, eastern white pine.	Imperial Carolina poplar.
47. Algansee	---	Amur privet, Amur maple, lilac, American cranberrybush.	White spruce, northern white-cedar.	Green ash, eastern white pine, Norway spruce, red maple.	Imperial Carolina poplar.
49B, 49C, 49D. Marlette	---	American cranberrybush, lilac, silky dogwood.	White spruce, Amur maple, Manchurian crabapple, nannyberry viburnum.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
50A. Mecosta	Manyflower cotoneaster.	Eastern redcedar, Siberian peashrub, American cranberrybush, lilac, silky dogwood.	White spruce, Manchurian crabapple.	Eastern white pine, Norway spruce, red pine, jack pine.	Imperial Carolina poplar.
51*. Pits					
52*. Udorthents					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
53*. Udorthents					
54*. Histosols.					
Aquents.					
55A*: Urban land.					
Mecosta	Manyflower cotoneaster.	Eastern redcedar, Siberian peashrub, American cranberrybush, lilac, silky dogwood.	White spruce	Eastern white pine, Norway spruce, red pine, jack pine.	Imperial Carolina poplar.
56A*: Urban land.					
Thetford	---	Silky dogwood, lilac, Amur maple, American cranberrybush, Amur privet.	White spruce, northern white-cedar.	Norway spruce, eastern white pine, red maple, green ash.	Imperial Carolina poplar.
57A*: Urban land.					
Londo	---	Amur privet, silky dogwood, lilac, American cranberrybush, Amur maple.	White spruce, northern white-cedar.	Norway spruce, green ash, red maple, eastern white pine.	Imperial Carolina poplar.
60B, 60C Guelph	---	American cranberrybush, lilac, silky dogwood.	White spruce, Manchurian crabapple, Amur maple, nannyberry viburnum, northern white-cedar.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
61A Selfridge	---	Silky dogwood, lilac, Amur maple, American cranberrybush, Amur privet.	Northern white-cedar, white spruce.	Eastern white pine, Norway spruce, green ash, red maple.	Imperial Carolina poplar.
62B, 62C, 62D Ormas	Manyflower cotoneaster.	Lilac, silky dogwood, eastern redcedar, American cranberrybush, Siberian peashrub.	White spruce	Eastern white pine, Norway spruce, red pine, jack pine.	Imperial Carolina poplar.
63B*, 63C*, 63D*, 63E*: Remus	---	Nannyberry viburnum, American cranberrybush, lilac, silky dogwood, Amur privet.	Northern white-cedar, white spruce.	Norway spruce, red pine, green ash, eastern white pine.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
63B*, 63C*, 63D*, 63E*:					
Spinks	Manyflower cotoneaster.	American cranberrybush, silky dogwood, eastern redcedar, lilac, Siberian peashrub.	Red pine, white spruce, jack pine.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
65B, 65C Arkport	---	Autumn-olive, Tatarian honeysuckle, nannyberry viburnum.	Norway spruce	Eastern white pine, Austrian pine, red pine.	Imperial Carolina poplar.
66B*, 66C*:					
Woodbeck	---	Lilac, silky dogwood, American cranberrybush.	Northern white-cedar, white spruce, Manchurian crabapple, nannyberry viburnum, Amur maple.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
Coloma	Manyflower cotoneaster.	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood.	White spruce	Eastern white pine, red pine, jack pine, Norway spruce.	Imperial Carolina poplar.
67B, 67C, 67D Remus	---	Nannyberry viburnum, American cranberrybush, lilac, silky dogwood, Amur privet.	Northern white-cedar, white spruce.	Norway spruce, red pine, green ash, eastern white pine.	Imperial Carolina poplar.
70B*:					
Ithaca	---	Silky dogwood, Amur maple, lilac, American cranberrybush, Amur privet.	Northern white-cedar, white spruce.	Eastern white pine, green ash, Norway spruce, red maple.	Imperial Carolina poplar.
Selfridge	---	Silky dogwood, lilac, Amur maple, American cranberrybush, Amur privet.	Northern white-cedar, white spruce.	Eastern white pine, Norway spruce, green ash, red maple.	Imperial Carolina poplar.
71 Cohoctah	---	Amur privet, American cranberrybush, lilac, nannyberry viburnum, silky dogwood.	Northern white-cedar, Manchurian crabapple, white spruce.	Green ash, eastern white pine.	Imperial Carolina poplar.
74 Shoals	---	Silky dogwood, lilac, Amur privet, Amur maple, American cranberrybush.	Northern white-cedar, white spruce.	Eastern white pine, Norway spruce, green ash, red maple.	Imperial Carolina poplar.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
10-------------------- Pinnebog	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
11B------------------- Spinks	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
11C------------------- Spinks	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
11D------------------- Spinks	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
12B------------------- Coloma	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
12C------------------- Coloma	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
12D, 12E-------------- Coloma	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
12F------------------- Coloma	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.	Severe: slope.
14B------------------- Tekenink	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: large stones, droughty.
14C------------------- Tekenink	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: large stones, droughty, slope.
15B------------------- Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
15C------------------- Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
15D------------------- Plainfield	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty, slope.
16A------------------- Wasepi	Severe: wetness.	Moderate: wetness, small stones.	Severe: small stones, wetness.	Moderate: wetness.	Moderate: small stones, wetness, droughty.
17-------------------- Cohoctah	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: flooding, wetness.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
18B Covert	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
19 Gilford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
20A Pipestone	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness.
21 Kingsville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
22B Perrinton	Slight	Slight	Moderate: slope.	Slight	Slight.
22C Perrinton	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
22D Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
23B Ithaca	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
24 Ziegenfuss	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
25B Wixom	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
26A Metamora	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
27 Corunna	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
29A Minoa	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
30 Lamson	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
33A Thetford	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
34 Belleville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
35B Metea	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
36 Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
39A Londo	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
40 Parkhill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
42-------------------- Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
45B*: Guelph---------------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Londo----------------	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
47------------------- Algansee	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: flooding, wetness.
49B------------------ Marlette	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Slight.
49C------------------ Marlette	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
49D------------------ Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
50A------------------ Mecosta	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
51*. Pits					
52*. Udorthents					
53*. Udipsamments					
54*: Histosols.					
Aquents.					
55A*: Urban land.					
Mecosta--------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
56A*: Urban land.					
Thetford-------------	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
57A*: Urban land.					
Londo----------------	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
60B------------------ Guelph	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
60C------------------- Guelph	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
61A------------------- Selfridge	Severe: wetness, too sandy.	Severe: too sandy.	Severe: too sandy, wetness.	Severe: too sandy.	Moderate: wetness, droughty.
62B------------------- Ormas	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
62C------------------- Ormas	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
62D------------------- Ormas	Severe: too sandy, slope.	Severe: too sandy, slope.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
63B*:					
Remus----------------	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: large stones, droughty.
Spinks---------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
63C*:					
Remus----------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: large stones, droughty, slope.
Spinks---------------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
63D*:					
Remus----------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Spinks---------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
63E*:					
Remus----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Spinks---------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.	Severe: slope.
65B, 65C-------------- Arkport	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: droughty.
66B*, 66C*:					
Woodbeck-------------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
66B*, 66C*:					
Coloma	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
67B Remus	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones, droughty.
67C Remus	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
67D Remus	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
70B*:					
Ithaca	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Selfridge	Severe: wetness, too sandy.	Severe: too sandy.	Severe: too sandy, wetness.	Severe: too sandy.	Moderate: wetness, droughty.
71 Cohoctah	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
74 Shoals	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
10 Pinnebog	Poor	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good.
11B Spinks	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
11C, 11D Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
12B Coloma	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
12C, 12D Coloma	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
12E Coloma	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
12F Coloma	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
14B, 14C Tekenink	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
15B Plainfield	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
15C, 15D Plainfield	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
16A Wasepi	Fair	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
17 Cohoctah	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
18B Covert	Poor	Poor	Fair	Good	Good	Poor	Poor	Poor	Good	Poor.
19 Gilford	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
20A Pipestone	Poor	Poor	Fair	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
21 Kingsville	Poor	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
22B Perrinton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
22C Perrinton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
22D Perrinton	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
23B Ithaca	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
24 Ziegenfuss	Poor	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
25B: Wixom	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
26A: Metamora	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
27: Corunna	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
29A: Minoa	Fair	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
30: Lamson	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
33A: Thetford	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
34: Belleville	Poor	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good
35B: Metea	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
36: Adrian	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
39A: Londo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
40: Parkhill	Poor	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
42: Edwards	Very poor.	Poor	Poor	Fair	Poor	Good	Good	Poor	Fair	Good.
45B*:										
Guelph	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Londo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
47: Algansee	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
49B: Marlette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
49C: Marlette	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
49D: Marlette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
50A: Mecosta	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
51*. Pits										
52*. Udorthents										
53*. Udipsamments										

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
54*:										
Histosols.										
Aquents.										
55A*:										
Urban land.										
Mecosta	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
56A*:										
Urban land.										
Thetford	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
57A*:										
Urban land.										
Londo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
60B Guelph	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
60C Guelph	Fair	Good	Good	Good	Good.	Very poor.	Very poor.	Good	Good	Very poor.
61A Selfridge	Poor	Poor	Good	Good	Good	Poor	Fair	Fair	Good	Poor.
62B Ormas	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
62C, 62D Ormas	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
63B*:										
Remus	Good	Fair	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Spinks	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
63C*, 63D*:										
Remus	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
63E*:										
Remus	Very poor.	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Spinks	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
65B, 65C Arkport	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
66B*, 66C*:										
Woodbeck	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Coloma	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
67B----------------- Remus	Good	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
67C, 67D------------ Remus	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
70B*:										
Ithaca--------------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Selfridge-----------	Poor	Poor	Good	Good	Good	Poor	Fair	Fair	Good	Poor.
71------------------ Cohoctah	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
74------------------ Shoals	Good	Good	Fair	Good	Good	Fair	Fair	Good	Good	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
10 Pinnebog	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
11B Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
11C Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
11D Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
12B Coloma	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
12C Coloma	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
12D, 12E, 12F Coloma	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
14B Tekenink	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: large stones, droughty.
14C Tekenink	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
15B Plainfield	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
15C Plainfield	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
15D Plainfield	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
16A Wasepi	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: small stones, wetness, droughty.
17 Cohoctah	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action, wetness.	Severe: flooding, wetness.
18B Covert	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
19 Gilford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
20A---------------- Pipestone	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
21----------------- Kingsville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
22B---------------- Perrinton	Moderate: too clayey, dense layer.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
22C---------------- Perrinton	Moderate: too clayey, dense layer, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
22D---------------- Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
23B---------------- Ithaca	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
24----------------- Ziegenfuss	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
25B---------------- Wixom	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
26A---------------- Metamora	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
27----------------- Corunna	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
29A---------------- Minoa	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
30----------------- Lamson	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
33A---------------- Thetford	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
34----------------- Belleville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
35B---------------- Metea	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Moderate: frost action.	Moderate: droughty.
36----------------- Adrian	Severe: ponding, cutbanks cave, excess humus.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
39A---------------- Londo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
40----------------- Parkhill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
42----------------- Edwards	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: excess humus, ponding.
45B*:						
Guelph------------	Slight----------	Slight----------	Slight----------	Moderate: slope.	Moderate: frost action.	Slight.
Londo-------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
47----------------- Algansee	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Moderate: flooding, wetness.
49B---------------- Marlette	Slight----------	Slight----------	Slight----------	Moderate: slope.	Severe: low strength.	Slight.
49C---------------- Marlette	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
49D---------------- Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
50A---------------- Mecosta	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Severe: droughty.
51*. Pits						
52*. Udorthents						
53*. Udipsamments						
54*: Histosols.						
Aquents.						
55A*: Urban land.						
Mecosta-----------	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Severe: droughty.
56A*: Urban land.						
Thetford----------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
57A*: Urban land.						
Londo-------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
60B---------------- Guelph	Slight----------	Slight----------	Slight----------	Moderate: slope.	Moderate: frost action.	Slight.
60C---------------- Guelph	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
61A---------------- Selfridge	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
62B---------------- Ormas	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty, too sandy.
62C---------------- Ormas	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope, too sandy.
62D---------------- Ormas	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
63B*:						
Remus-------------	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: large stones, droughty.
Spinks------------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty, too sandy.
63C*:						
Remus-------------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
Spinks------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
63D*, 63E*:						
Remus-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Spinks------------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
65B, 65C---------- Arkport	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty.
66B*, 66C*:						
Woodbeck----------	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Coloma------------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty, too sandy.
67B---------------- Remus	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: large stones, droughty.
67C---------------- Remus	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
67D---------------- Remus	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
70B*:						
Ithaca-----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Selfridge--------	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
71---------------- Cohoctah	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action, wetness.	Severe: wetness.
74---------------- Shoals	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
10 Pinnebog	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
11B Spinks	Slight	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
11C Spinks	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
11D Spinks	Severe: slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
12B Coloma	Severe:* poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
12C Coloma	Severe:* poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
12D, 12E, 12F Coloma	Severe:* poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope.
14B Tekenink	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
14C Tekenink	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: small stones, slope.
15B Plainfield	Severe:* poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
15C Plainfield	Severe:* poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
15D Plainfield	Severe:* slope, poor filter.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
16A Wasepi	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
17 Cohoctah	Severe: wetness, flooding, poor filter.	Severe: flooding, seepage, wetness.	Severe: seepage, flooding, wetness.	Severe: seepage, flooding, wetness.	Poor: wetness.
18B Covert	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
19 Gilford	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, small stones.
20A Pipestone	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
21 Kingsville	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
22B Perrinton	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
22C Perrinton	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
22D Perrinton	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
23B Ithaca	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
24 Ziegenfuss	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: hard to pack, ponding, too clayey.
25B Wixom	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
26A Metamora	Severe: percs slowly, wetness.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
27 Corunna	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
29A Minoa	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
30 Lamson	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
33A Thetford	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
34 Belleville	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
35B Metea	Moderate: percs slowly.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
36-------------------- Adrian	Severe: ponding, poor filter.	Severe: seepage, ponding, excess humus.	Severe: ponding, seepage.	Severe: ponding, seepage.	Poor: ponding, excess humus.
39A------------------ Londo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
40------------------- Parkhill	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
42------------------- Edwards	Severe: ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding, excess humus.
45B:					
Guelph--------------	Slight-----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
Londo---------------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
47------------------- Algansee	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
49B------------------ Marlette	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
49C------------------ Marlette	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
49D------------------ Marlette	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
50A------------------ Mecosta	Severe:* poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
51. Pits					
52. Udorthents					
53. Udipsamments					
54: Histosols.					
Aquents.					
55A: Urban land.					

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
55A:					
Mecosta	Severe:* poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
56A:					
Urban land.					
Thetford	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
57A:					
Urban land.					
Londo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
60B Guelph	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
60C Guelph	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
61A Selfridge	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
62B Ormas	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
62C Ormas	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
62D Ormas	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: thin layer, slope.
63B:					
Remus	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Spinks	Slight	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
63C:					
Remus	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Spinks	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
63D, 63E:					
Remus	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
63D, 63E:					
Spinks	Severe: slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
65B, 65C Arkport	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: too sandy, thin layer.
66B, 66C:					
Woodbeck	Severe:* percs slowly, poor filter.	Severe: seepage.	Severe: seepage, too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
Coloma	Severe:* poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
67B Remus	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
67C Remus	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
67D Remus	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
70B:					
Ithaca	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Selfridge	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
71 Cohoctah	Severe: wetness, flooding, poor filter.	Severe: flooding, seepage, wetness.	Severe: seepage, flooding, wetness.	Severe: seepage, flooding, wetness.	Poor: wetness.
74 Shoals	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.

* The effluent drains satisfactorily, but there is a danger of groundwater pollution.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
10 Pinnebog	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
11B, 11C Spinks	Good	Probable	Improbable: too sandy.	Poor: too sandy.
11D Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
12B, 12C Coloma	Good	Probable	Improbable: too sandy.	Poor: too sandy.
12D, 12E Coloma	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
12F Coloma	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
14B, 14C Tekenink	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
15B, 15C Plainfield	Good	Probable	Improbable: too sandy.	Poor: too sandy.
15D Plainfield	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
16A Wasepi	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
17 Cohoctah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
18B Covert	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
19 Gilford	Poor: wetness.	Probable	Probable	Poor: wetness, area reclaim.
20A Pipestone	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
21 Kingsville	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness, too sandy.
22B, 22C Perrinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
22D Perrinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
23B Ithaca	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
24 Ziegenfuss	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
25B Wixom	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
26A Metamora	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
27 Corunna	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
29A Minoa	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
30 Lamson	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
33A Thetford	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy, small stones.
34 Belleville	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
35B Metea	Poor: thin layer.	Improbable: thin layer.	Improbable: too sandy.	Fair: too sandy.
36 Adrian	Poor: wetness, low strength.	Probable	Improbable: too sandy.	Poor: wetness, excess humus.
39A Londo	Fair: wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
40 Parkhill	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
42 Edwards	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
45B*:				
Guelph	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Londo	Fair: wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
47 Algansee	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
49B Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
49C Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
49D Marlette	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
50A Mecosta	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
51*. Pits				
52*. Udorthents				
53*. Udipsamments				
54*: Histosols.				
Aquents.				
55A*: Urban land.				
Mecosta	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
56A*: Urban land.				
Thetford	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy, small stones.
57A*: Urban land.				
Londo	Fair: wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
60B Guelph	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
60C Guelph	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
61A Selfridge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
62B, 62C Ormas	Good	Probable	Probable	Poor: too sandy.
62D Ormas	Fair: slope.	Probable	Probable	Poor: too sandy.
63B*, 63C*: Remus	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Spinks	Good	Probable	Improbable: too sandy.	Poor: too sandy.
63D*: Remus	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
63D*:				
Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
63E*:				
Remus	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Spinks	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
65B, 65C Arkport	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
66B*, 66C*:				
Woodbeck	Good	Probable	Probable	Poor: thin layer.
Coloma	Good	Probable	Improbable: too sandy.	Poor: too sandy.
67B, 67C Remus	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
67D Remus	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
70B*:				
Ithaca	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Selfridge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
71 Cohoctah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
74 Shoals	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
10: Pinnebog	Severe: seepage.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
11B: Spinks	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
11C, 11D: Spinks	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
12B: Coloma	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
12C, 12D, 12E, 12F: Coloma	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
14B: Tekenink	Moderate: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Soil blowing	Droughty.
14C: Tekenink	Severe: slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, soil blowing.	Slope, droughty.
15B: Plainfield	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
15C, 15D: Plainfield	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Droughty, slope.
16A: Wasepi	Severe: seepage.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
17: Cohoctah	Severe: seepage.	Slight	Flooding, frost action.	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
18B: Covert	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
19: Gilford	Severe: seepage.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
20A: Pipestone	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
21: Kingsville	Severe: seepage.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
22B: Perrinton	Moderate: slope.	Severe: no water.	Deep to water	Slope	Favorable	Favorable.
22C, 22D: Perrinton	Severe: slope.	Severe: no water.	Deep to water	Slope	Slope	Slope.
23B: Ithaca	Slight	Severe: no water.	Frost action	Wetness	Wetness	Wetness.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
24: Ziegenfuss	Slight	Severe: slow refill.	Ponding, frost action, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
25B: Wixom	Severe: seepage.	Severe: no water.	Slope	Wetness, droughty, fast intake.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, droughty.
26A: Metamora	Slight	Severe: slow refill.	Frost action	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
27: Corunna	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Erodes easily, ponding, too sandy.	Wetness, erodes easily.
29A: Minoa	Severe: seepage.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, fast intake.	Wetness	Wetness.
30: Lamson	Severe: seepage.	Severe: cutbanks cave.	Frost action	Wetness	Wetness	Wetness.
33A: Thetford	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
34: Belleville	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, frost action.	Ponding, droughty, fast intake.	Ponding, soil blowing.	Wetness, droughty.
35B: Metea	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
36: Adrian	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, frost action, subsides.	Ponding, soil blowing.	Ponding, soil blowing, too sandy.	Wetness.
39A: Londo	Moderate: seepage.	Severe: slow refill.	Frost action	Wetness	Wetness	Wetness.
40: Parkhill	Moderate: seepage.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
42: Edwards	Severe: seepage.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
45B*:						
Guelph	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope	Favorable	Favorable.
Londo	Moderate: seepage.	Severe: slow refill.	Frost action	Wetness	Wetness	Wetness.
47: Algansee	Severe: seepage.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
49B: Marlette	Moderate: slope.	Severe: no water.	Deep to water	Slope	Favorable	Favorable.
49C, 49D: Marlette	Severe: slope.	Severe: no water.	Deep to water	Slope	Slope	Slope.
50A: Mecosta	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Large stones, too sandy.	Large stones, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
51*. Pits						
52*. Udorthents						
53*. Udipsamments						
54*: Histosols.						
Aquents.						
55A*: Urban land.						
Mecosta.						
56A*: Urban land.						
Thetford.						
57A*: Urban land.						
Londo.						
60B---------------- Guelph	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope----------	Favorable------	Favorable.
60C---------------- Guelph	Severe: slope.	Severe: no water.	Deep to water	Slope----------	Slope----------	Slope.
61A---------------- Selfridge	Severe: seepage.	Severe: no water.	Frost action---	Wetness, fast intake, soil blowing.	Wetness, soil blowing, erodes easily.	Wetness, erodes easily.
62B---------------- Ormas	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Soil blowing---	Droughty.
62C, 62D----------- Ormas	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, soil blowing.	Slope, droughty.
63B*: Remus------------	Moderate: seepage, slope.	Severe: no water.	Deep to water	Droughty, soil blowing.	Soil blowing---	Droughty.
Spinks-----------	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
63C*, 63D*, 63E*: Remus------------	Severe: slope.	Severe: no water.	Deep to water	Droughty, soil blowing.	Slope, soil blowing.	Slope, droughty.
Spinks-----------	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
65B, 65C----------- Arkport	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, slope.	Favorable------	Droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
66B*, 66C*:						
Woodbeck	Severe: seepage.	Severe: no water.	Deep to water	Rooting depth	Favorable	Rooting depth.
Coloma	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
67B Remus	Moderate: seepage, slope.	Severe: no water.	Deep to water	Droughty, soil blowing.	Soil blowing	Droughty.
67C, 67D Remus	Severe: slope.	Severe: no water.	Deep to water	Droughty, soil blowing.	Slope, soil blowing.	Slope, droughty.
70B*:						
Ithaca	Slight	Severe: no water.	Frost action	Wetness	Wetness	Wetness.
Selfridge	Severe: seepage.	Severe: no water.	Frost action	Wetness, fast intake, soil blowing.	Wetness, soil blowing, erodes easily.	Wetness, erodes easily.
71 Cohoctah	Severe: seepage.	Slight	Flooding, frost action.	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
74 Shoals	Moderate: seepage.	Moderate: slow refill.	Flooding, frost action.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Wetness, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
10---------------- Pinnebog	0-18	Sapric material	P	A-8	0	---	---	---	---	---	---
	18-26	Hemic material---	P	A-8	0	---	---	---	---	---	---
	26-60	Sapric material	P	A-8	0	---	---	---	---	---	---
11B, 11C, 11D---- Spinks	0-20	Sand-------------	SP-SM, SM	A-2-4, A-3	0	100	80-100	50-90	5-20	---	NP
	20-60	Stratified fine sand to loamy fine sand.	SM, SP-SM	A-2-4	0	100	80-100	60-90	10-30	---	NP
12B, 12C, 12D, 12E, 12F-------- Coloma	0-41	Sand-------------	SP, SM, SP-SM	A-2, A-3	0-10	85-100	85-100	50-70	2-15	---	NP
	41-60	Stratified sand to sandy loam.	SP, SM, SP-SM	A-2, A-3, A-4	0-10	85-100	85-100	50-100	2-40	---	NP
14B, 14C--------- Tekenink	0-16	Loamy fine sand	SM, SM-SC	A-2-4, A-4, A-1-B	0-10	95-100	80-100	45-95	15-40	<25	NP-6
	16-33	Fine sandy loam, loam, loamy sand.	SM, SM-SC, SC	A-4, A-2-4	0-10	95-100	80-100	50-85	20-50	<25	NP-10
	33-46	Fine sandy loam, sandy loam, sandy clay loam.	SM-SC, SM, SP-SM, GM	A-4, A-2-4, A-2-6, A-6	0-10	95-100	80-100	55-85	25-55	<30	4-15
	46-60	Sandy loam, fine sandy loam, loamy fine sand.	GP-GM, GP	A-4, A-2-4	0-10	95-100	80-100	50-95	20-45	<25	NP-10
15B, 15C, 15D---- Plainfield	0-7	Sand-------------	SP-SM, SM, SP	A-3, A-2, A-1	0	75-100	75-100	40-80	3-35	---	NP
	7-21	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	40-70	1-15	---	NP
	21-60	Sand, fine sand	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	40-90	1-15	---	NP
16A-------------- Wasepi	0-10	Loamy sand-------	SM	A-2	0-5	85-100	70-95	50-65	15-30	---	NP
	10-28	Loamy sand, sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	85-100	70-95	55-85	20-45	15-35	2-16
	28-60	Sand, fine sand, gravelly sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2	0-10	40-80	35-70	30-60	0-10	---	NP
17--------------- Cohoctah	0-13	Fine sandy loam	ML, SM	A-4, A-2	0	100	100	65-95	30-75	<30	NP-6
	13-35	Loam, fine sandy loam, loamy fine sand.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	70-90	30-70	<30	NP-10
	35-60	Sand, sandy loam, loamy sand.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	65-90	20-70	<30	NP-10
18B-------------- Covert	0-5	Sand-------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-15	---	NP
	5-35	Sand-------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
	35-60	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
19--------------- Gilford	0-11	Fine sandy loam	SM, SC, SM-SC	A-4	0	95-100	90-100	65-80	35-45	15-25	2-10
	11-24	Sandy loam, fine sandy loam, gravelly sandy loam.	SM, SC, SM-SC	A-2-4	0	90-100	70-100	55-70	25-35	20-30	NP-8
	24-29	Coarse sand, sand, loamy sand.	SM, SP, SP-SM	A-3, A-1-B, A-2-4	0	90-100	85-100	18-60	3-18	---	NP
	29-60	Gravelly sand, gravelly coarse sand, very gravelly sand.	SP, SP-SM, GP, GP-GM	A-1	0-15	40-85	35-80	20-50	3-10	---	NP

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
20A---------------- Pipestone	0-4	Sand--------------	SP, SM, SP-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	4-31	Sand, loamy sand, fine sand.	SP-SM, SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	31-60	Sand, fine sand	SP-SM, SP	A-3, A-2-4	0	95-100	90-100	50-80	0-10	---	NP
21---------------- Kingsville	0-8	Loamy fine sand	SM	A-2, A-4	0	100	90-100	50-80	15-45	---	NP
	8-40	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-4	0	100	90-100	50-80	10-45	---	NP
	40-60	Fine sand, sand, loamy fine sand.	SM, SW-SM, SP-SM	A-2, A-3, A-4, A-1	0	95-100	85-100	45-80	5-45	---	NP
22B, 22C, 22D----- Perrinton	0-11	Loam--------------	ML, CL, CL-ML	A-4, A-6	0-5	95-100	95-100	80-100	55-80	18-35	2-15
	11-36	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0-5	95-100	95-100	80-100	65-90	25-55	11-30
	36-60	Clay loam, silty clay loam.	CL	A-6	0-5	95-100	95-100	90-100	65-90	25-36	11-18
23B--------------- Ithaca	0-10	Loam--------------	CL	A-4, A-6	0-3	95-100	95-100	80-100	55-85	25-35	7-15
	10-30	Clay loam, silty clay loam, clay.	CL, CH	A-7	0-3	95-100	90-100	85-100	60-90	40-55	20-30
	30-60	Clay loam, silty clay loam, clay.	CL, CH	A-7	0-3	95-100	90-100	85-100	60-90	40-55	20-30
24---------------- Ziegenfuss	0-9	Loam--------------	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	90-95	60-75	25-35	5-15
	9-34	Clay loam, silty clay loam, clay.	CL, CH	A-7	0-5	95-100	90-100	90-95	65-85	40-55	20-32
	34-60	Clay loam, silty clay loam, clay.	CL, CH	A-7	0-5	95-100	90-100	90-95	70-85	40-55	20-32
25B--------------- Wixom	0-9	Loamy sand--------	SM	A-2-4	0	95-100	95-100	50-70	15-30	---	NP
	9-30	Loamy sand, sand, loamy fine sand.	SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	5-30	<20	NP-4
	30-60	Silty clay loam, sandy clay loam, loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	51-95	20-40	5-25
26A--------------- Metamora	0-9	Fine sandy loam	SM, SM-SC	A-2, A-4	0-5	95-100	95-100	60-80	25-45	<25	NP-7
	9-24	Sandy loam, loamy sand.	SM, SM-SC	A-2, A-4	0-5	95-100	90-100	50-80	15-45	<25	NP-7
	24-33	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	90-100	80-100	60-85	20-45	5-25
	33-60	Clay loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	90-100	80-100	60-85	20-45	5-25
27---------------- Corunna	0-11	Sandy loam--------	SM, ML, SC, CL	A-2, A-4	0-5	95-100	95-100	65-85	25-70	<30	NP-10
	11-33	Sandy loam, loamy sand, fine sandy loam.	SM, SC, SM-SC	A-4, A-2	0-5	95-100	95-100	50-75	15-40	<30	NP-10
	33-60	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	100	95-100	90-100	70-90	25-50	11-25
29A--------------- Minoa	0-18	Loamy fine sand.	ML, SM	A-4	0	95-100	90-100	75-100	35-90	<20	NP-4
	18-38	Loamy very fine sand, loamy fine sand, fine sandy loam.	ML, SM	A-4	0	95-100	90-100	65-95	35-90	<20	NP-4
	38-60	Loamy very fine sand, fine sandy loam, silt loam.	SM, ML	A-4	0	95-100	90-100	65-95	35-90	<20	NP-4
	38-60	Loamy fine sand, very fine sand, silt loam.	SM, ML	A-2, A-4	0	95-100	90-100	60-100	20-90	<20	NP-4

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
30---------------- Lamson	0-11	Fine sandy loam	SM, ML	A-4	0	95-100	90-100	70-90	40-85	<20	NP-4
	11-30	Fine sandy loam, very fine sandy loam.	SM, ML	A-4	0	95-100	80-100	55-95	45-65	<20	NP-4
	30-60	Fine sand, very fine sand, silt loam.	SM, ML	A-2, A-4	0	95-100	80-100	60-90	20-90	---	NP
33A--------------- Thetford	0-27	Loamy sand, sand	SM	A-2, A-4	0	95-100	90-100	70-85	20-45	<20	NP-4
	27-38	Sand, sandy loam, loamy sand.	SM	A-2, A-4	0	95-100	90-100	60-80	20-40	<20	NP-4
	38-60	Very fine sand, fine sand, sand.	SM, SP, SP-SM	A-2, A-4, A-3	0	95-100	70-100	50-85	0-45	<20	NP-4
34---------------- Belleville	0-12	Loamy sand--------	SM	A-2	0	100	95-100	70-85	20-35	<20	NP-4
	12-33	Sand, loamy sand, loamy fine sand.	SM	A-2	0-3	95-100	90-100	50-85	15-30	<20	NP-4
	33-60	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0-3	95-100	90-100	90-100	70-90	25-50	10-25
35B--------------- Metea	0-9	Loamy sand--------	SM	A-2-4	0	100	100	50-80	15-35	---	NP
	9-22	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	10-35	---	NP
	22-28	Loam, sandy clay loam, silty clay loam.	CL, SC	A-6	0	90-100	90-95	75-95	40-75	30-40	10-15
	28-60	Loam, silty clay loam, clay loam.	CL, CL-ML	A-4, A-6	0-3	85-95	80-90	75-90	50-75	25-35	5-15
36---------------- Adrian	0-26	Sapric material.	P	A-8	---	---	---	---	---	---	---
	26-60	Sand, loamy sand, fine sand.	SP, SM	A-2, A-3, A-1	0	80-100	60-100	35-75	0-30	---	NP
39A--------------- Londo	0-9	Loam--------------	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	50-75	20-30	2-10
	9-22	Clay loam, loam	CL, ML	A-6	0	95-100	90-100	85-95	60-80	30-40	11-20
	22-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	80-90	55-75	30-40	10-20
40---------------- Parkhill	0-9	Loam--------------	CL-ML, CL	A-4, A-6	0-5	95-100	90-100	85-95	60-85	20-40	6-18
	9-35	Clay loam, loam, silty clay loam.	CL	A-6	0-5	95-100	90-100	85-100	65-95	25-40	10-20
	35-60	Loam--------------	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	80-90	60-75	15-35	5-15
42---------------- Edwards	0-24	Sapric material	P	A-8	0	---	---	---	---	---	---
	24-60	Marl--------------	---	---	0	100	95-100	80-90	60-80	---	---
45B*:											
Guelph-----------	0-9	Loam--------------	ML, SM, SC, CL	A-4, A-2, A-6	0-5	95-100	90-95	55-90	25-70	20-35	2-12
	9-25	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-95	85-90	70-85	25-40	5-20
	25-60	Loam, clay loam	CL-ML, CL	A-6, A-4	0-5	95-100	85-95	75-95	55-75	20-30	4-14
Londo------------	0-9	Loam--------------	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	50-75	20-30	2-10
	9-22	Clay loam, loam	CL, ML	A-6	0	95-100	90-100	85-95	60-80	30-40	11-20
	22-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	80-90	55-75	30-40	10-20
47---------------- Algansee	0-8	Loamy sand--------	SM	A-2-4	0	100	100	50-75	15-30	---	NP
	8-60	Stratified sand to loam.	SM, SP-SM	A-3, A-2-4	0	100	100	50-70	5-15	---	NP
49B, 49C, 49D----- Marlette	0-9	Loam--------------	CL, ML, CL-ML	A-4	0-5	95-100	85-95	80-95	60-70	20-30	3-10
	9-40	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	80-95	55-90	20-40	5-25
	40-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
50A--------------- Mecosta	0-9	Sand-------------	SM, SP-SM	A-3, A-2-4	0-5	90-100	90-100	50-95	5-15	---	NP
	9-20	Sand, gravelly sand, loamy sand.	SM, SP-SM, SM-SC	A-1, A-3, A-2-4	0-15	75-100	65-95	45-75	5-30	<20	NP-5
	20-24	Gravelly loamy sand, gravelly sandy loam.	SM-SC, SM, SP-SM, GM	A-2-4, A-1-B	0-15	40-70	40-70	35-65	10-30	<20	NP-5
	24-60	Gravelly sand, extremely gravelly sand, very gravelly sand.	GP-GM, GP	A-1-A, A-1-B	0-25	20-50	20-50	20-50	0-10	---	NP
51*. Pits											
52*. Udorthents											
53*. Udipsamments											
54*: Histosols.											
Aquents.											
55A*: Urban land.											
Mecosta---------	0-9	Sand-------------	SM, SP-SM	A-3, A-2-4	0-5	90-100	90-100	50-95	5-15	---	NP
	9-20	Sand, gravelly sand, loamy sand.	SM, SP-SM, SM-SC	A-1, A-3, A-2-4	0-15	75-100	65-95	45-75	5-30	<20	NP-5
	20-24	Gravelly loamy sand, gravelly sandy loam.	SM-SC, SM, SP-SM, GM	A-2-4, A-1-B	0-15	40-70	40-70	35-65	10-30	<20	NP-5
	24-60	Gravelly sand, extremely gravelly sand, very gravelly sand.	GP-GM, GP	A-1-A, A-1-B	0-25	20-50	20-50	20-50	0-10	---	NP
56A*: Urban land.											
Thetford--------	0-27	Loamy sand, sand	SM	A-2, A-4	0	95-100	90-100	70-85	20-45	<20	NP-4
	27-38	Loamy sand, sandy loam, sand.	SM	A-2, A-4	0	95-100	90-100	60-80	20-40	<20	NP-4
	38-60	Very fine sand, fine sand, sand.	SM, SP, SP-SM	A-2, A-4, A-3	0	95-100	70-100	50-85	0-45	<20	NP-4
57A*: Urban land.											
Londo-----------	0-9	Loam-------------	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	50-75	20-30	2-10
	9-22	Clay loam, loam	CL, ML	A-6	0	95-100	90-100	85-95	60-80	30-40	11-20
	22-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	80-90	55-75	30-40	10-20
60B, 60C--------- Guelph	0-9	Loam-------------	ML, SM, SC, CL	A-4, A-2, A-6	0-5	95-100	90-95	55-90	25-70	20-35	2-12
	9-25	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-95	85-90	70-85	25-40	5-20
	25-60	Loam, clay loam	CL-ML, CL	A-6, A-4	0-5	95-100	85-95	75-95	55-75	20-30	4-14

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
61A------------- Selfridge	0-30	Sand-------------	SM, SP-SM	A-2, A-3	0-5	95-100	95-100	55-85	5-30	---	NP
	30-34	Sandy loam-------	SM, SC, SM-SC	A-2, A-4	0-5	95-100	95-100	65-80	25-45	15-30	NP-10
	34-60	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-90	25-50	10-25
62B, 62C, 62D---- Ormas	0-22	Sand-------------	SM	A-2-4	0	98-100	95-100	50-75	15-30	---	NP
	22-33	Sandy clay loam, very gravelly sand.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2-4, A-2-6	0	60-80	55-80	35-70	20-45	20-40	6-20
	33-60	Very gravelly sand.	SP, SP-SM	A-3, A-1-B, A-2-4	0	60-80	55-80	30-55	3-12	---	NP
63B*, 63C*, 63D*, 63E*:											
Remus----------	0-9	Fine sandy loam	SM, SM-SC	A-2, A-4	0-10	85-100	85-95	55-85	25-45	<25	NP-7
	9-43	Sandy loam, sandy clay loam, loam.	SC, SP-SC	A-2, A-6	0-10	85-100	85-95	45-90	10-45	20-30	10-15
	43-60	Sandy loam, sandy clay loam.	SC	A-2, A-6	0-10	85-100	85-95	55-90	25-45	25-40	10-20
Spinks---------	0-20	Sand-------------	SP-SM, SM	A-2-4, A-3	0	100	80-100	50-90	5-20	---	NP
	20-60	Stratified fine sand to loamy fine sand.	SM, SP-SM	A-2-4	0	100	80-100	60-90	10-30	---	NP
65B, 65C--------- Arkport	0-11	Loamy fine sand	SM	A-2, A-4	0	95-100	95-100	65-85	20-45	---	NP
	11-23	Very fine sandy loam, loam, loamy fine sand.	SM, ML	A-2, A-4	0	95-100	95-100	70-95	30-65	<15	NP-4
	23-60	Loamy fine sand, fine sand, loamy very fine sand.	SM	A-2, A-4	0	95-100	95-100	60-95	15-50	---	NP
66B*, 66C*:											
Woodbeck--------	0-8	Loam-------------	CL	A-4, A-6	0	100	95-100	85-100	60-90	25-35	7-15
	8-24	Clay loam, silty clay, clay.	CH, CL	A-7	0	100	95-100	90-100	75-100	40-60	20-35
	24-60	Sand, loamy sand, gravelly sand.	SP, SM, SP-SM	A-1, A-2, A-3	0	70-100	70-100	15-70	2-25	---	NP
Coloma----------	0-41	Sand-------------	SP, SM, SP-SM	A-2, A-3	0-10	85-100	85-100	50-70	2-15	---	NP
	41-60	Stratified sand to sandy loam.	SP, SM, SP-SM	A-2, A-3, A-4	0-10	85-100	85-100	50-100	2-40	---	NP
67B, 67C, 67D---- Remus	0-9	Sandy loam-------	SM, SM-SC	A-2, A-4	0-10	85-100	85-95	55-85	25-45	<25	NP-7
	9-43	Sandy loam, sandy clay loam, loam.	SC, SP-SC	A-2, A-6	0-10	85-100	85-95	45-90	10-45	20-30	10-15
	43-60	Sandy loam, sandy clay loam.	SC	A-2, A-6	0-10	85-100	85-95	55-90	25-45	25-40	10-20
70B*:											
Ithaca----------	0-10	Loam-------------	CL	A-4, A-6	0-3	95-100	95-100	80-100	55-85	25-35	7-15
	10-30	Clay loam, silty clay loam, clay.	CL, CH	A-7	0-3	95-100	90-100	85-100	60-90	40-55	20-30
	30-60	Clay loam, silty clay loam, clay.	CL, CH	A-7	0-3	95-100	90-100	85-100	60-90	40-55	20-30
Selfridge-------	0-30	Sand-------------	SM, SP-SM	A-2, A-3	0-5	95-100	95-100	55-85	5-30	---	NP
	30-34	Sandy loam-------	SM, SC, SM-SC	A-2, A-4	0-5	95-100	95-100	65-80	25-45	15-30	NP-10
	34-60	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-90	25-50	10-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
71----------------- Cohoctah	0-13	Fine sandy loam	ML, SM	A-4, A-2	0	100	100	65-95	30-75	<30	NP-6
	13-35	Loam, fine sandy loam, loamy fine sand.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	70-90	30-70	<30	NP-10
	35-60	Loam, sandy loam, loamy sand.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	65-90	20-70	<30	NP-10
74----------------- Shoals	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-90	20-35	6-15
	9-40	Silt loam, loam, clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-85	25-40	5-15
	40-60	Stratified silt loam to sandy loam.	ML, CL, CL-ML	A-4	0-3	90-100	85-100	60-80	50-70	<30	4-10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
10---------------- Pinnebog	0-18	---	0.30-0.40	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	2	2	40-80
	18-26	---	0.10-0.25	0.6-6.0	0.45-0.55	5.6-7.8	-------------	----			
	26-60	---	0.10-0.25	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----			
11B, 11C, 11D---- Spinks	0-20	0-10	1.20-1.60	6.0-20	0.06-0.08	5.1-7.3	Low-----------	0.17	5	1	2-4
	20-60	0-15	1.20-1.50	2.0-6.0	0.04-0.08	5.6-7.8	Low-----------	0.17			
12B, 12C, 12D, 12E, 12F-------- Coloma	0-41	1-9	1.35-1.65	6.0-20	0.06-0.09	5.1-6.0	Low-----------	0.15	5	1	<1
	41-60	1-10	1.50-1.65	6.0-20	0.03-0.08	5.1-6.5	Low-----------	0.15			
14B, 14C--------- Tekenink	0-16	2-12	1.15-1.60	2.0-6.0	0.08-0.12	5.1-7.3	Low-----------	0.17	5	2	1-3
	16-33	2-15	1.25-1.60	0.6-2.0	0.08-0.17	5.1-7.3	Low-----------	0.24			
	33-46	10-22	1.25-1.70	0.6-2.0	0.10-0.17	5.1-7.3	Low-----------	0.24			
	46-60	2-15	1.30-1.70	0.6-6.0	0.08-0.16	7.4-8.4	Low-----------	0.24			
15B, 15C, 15D---- Plainfield	0-7	2-5	1.50-1.65	6.0-20	0.04-0.09	4.5-7.3	Low-----------	0.15	5	1	<1
	7-21	0-4	1.50-1.65	6.0-20	0.04-0.07	4.5-6.5	Low-----------	0.17			
	21-60	0-4	1.50-1.70	6.0-20	0.04-0.07	4.5-6.5	Low-----------	0.17			
16A--------------- Wasepi	0-10	0-10	1.25-1.40	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.20	4	2	1-4
	10-28	10-18	1.35-1.45	2.0-6.0	0.12-0.18	5.6-7.3	Low-----------	0.20			
	28-60	0-10	1.25-1.50	>20	0.02-0.04	7.4-7.8	Low-----------	0.10			
17---------------- Cohoctah	0-13	5-20	1.20-1.60	2.0-6.0	0.13-0.22	6.1-7.8	Low-----------	0.28	5	3	1-4
	13-35	5-27	1.45-1.65	2.0-6.0	0.12-0.20	6.1-8.4	Low-----------	0.28			
	35-60	5-10	1.40-1.55	6.0-20	0.04-0.08	6.1-8.4	Low-----------	0.28			
18B--------------- Covert	0-5	2-10	1.25-1.55	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.15	5	1	1-2
	5-35	2-10	1.25-1.60	6.0-20	0.05-0.08	4.5-7.3	Low-----------	0.15			
	35-60	0-10	1.45-1.65	6.0-20	0.04-0.07	5.6-7.3	Low-----------	0.15			
19---------------- Gilford	0-11	10-20	1.50-1.70	2.0-6.0	0.16-0.18	5.6-7.3	Low-----------	0.20	4	3	2-4
	11-24	8-17	1.60-1.80	2.0-6.0	0.10-0.14	5.6-7.3	Low-----------	0.20			
	24-29	3-12	1.70-1.90	6.0-20	0.05-0.08	6.6-8.4	Low-----------	0.15			
	29-60	1-5	1.70-1.90	>20	0.02-0.04	6.6-8.4	Low-----------	0.10			
20A--------------- Pipestone	0-4	2-12	1.20-1.60	6.0-20	0.07-0.10	4.5-7.3	Low-----------	0.17	5	1	3-4
	4-31	2-12	1.20-1.60	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.17			
	31-60	2-12	1.20-1.60	6.0-20	0.05-0.07	5.1-7.3	Low-----------	0.17			
21---------------- Kingsville	0-8	2-12	1.20-1.50	6.0-20	0.07-0.12	4.5-6.0	Low-----------	0.17	5	2	3-6
	8-40	2-12	1.20-1.50	6.0-20	0.07-0.12	4.5-6.5	Low-----------	0.17			
	40-60	2-10	1.45-1.65	6.0-20	0.07-0.10	5.6-7.3	Low-----------	0.17			
22B, 22C, 22D---- Perrinton	0-11	10-22	1.50-1.85	0.6-2.0	0.20-0.24	5.1-6.5	Low-----------	0.32	4	6	1-3
	11-36	35-50	1.50-1.80	0.2-0.6	0.10-0.20	5.1-6.5	Moderate-----	0.32			
	36-60	35-50	1.65-1.95	0.2-0.6	0.14-0.20	7.9-8.4	Moderate-----	0.32			
23B--------------- Ithaca	0-10	8-27	1.40-1.70	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.32	5	6	1-4
	10-30	35-50	1.40-1.65	0.2-0.6	0.10-0.20	5.1-7.8	Moderate-----	0.32			
	30-60	30-50	1.50-1.65	0.2-0.6	0.13-0.20	7.9-8.4	Moderate-----	0.32			
24---------------- Ziegenfuss	0-9	15-27	1.35-1.55	0.6-2.0	0.18-0.22	5.6-7.8	Low-----------	0.32	5	5	1-4
	9-34	35-50	1.40-1.70	0.2-0.6	0.14-0.20	5.6-7.8	Moderate-----	0.32			
	34-60	35-50	1.50-1.75	0.06-0.2	0.13-0.20	7.4-8.4	Moderate-----	0.32			
25B--------------- Wixom	0-9	2-12	1.20-1.60	6.0-20	0.10-0.12	5.1-6.5	Low-----------	0.15	5	2	2-4
	9-30	2-14	1.40-1.70	6.0-20	0.06-0.11	5.1-6.5	Low-----------	0.15			
	30-60	18-35	1.30-1.70	0.2-0.6	0.14-0.20	6.1-7.8	Moderate-----	0.43			

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
26A----------------	0-9	5-15	1.25-1.40	2.0-6.0	0.14-0.18	5.1-7.3	Low-----------	0.20	5	3	1-2
Metamora	9-24	5-15	1.40-1.60	2.0-6.0	0.10-0.15	5.1-7.3	Low-----------	0.20			
	24-33	18-35	1.45-1.70	0.2-0.6	0.16-0.18	6.1-7.3	Moderate-----	0.32			
	33-60	12-30	1.45-1.70	0.2-0.6	0.14-0.18	6.6-8.4	Moderate-----	0.32			
27-----------------	0-11	5-15	1.60-1.70	0.6-6.0	0.14-0.22	6.1-7.8	Low-----------	0.20	4	3	1-2
Corunna	11-33	10-18	1.30-1.60	0.6-6.0	0.08-0.14	6.1-7.8	Low-----------	0.20			
	33-60	18-35	1.45-1.70	0.2-0.6	0.16-0.20	7.4-8.4	Moderate-----	0.43			
29A----------------	0-18	5-18	1.20-1.50	0.6-2.0	0.13-0.21	5.1-7.3	Low-----------	0.32	4	---	3-6
Minoa	18-38	5-18	1.20-1.50	0.6-2.0	0.13-0.20	5.1-7.3	Low-----------	0.32			
	38-60	3-15	1.20-1.50	0.6-2.0	0.13-0.20	5.6-7.3	Low-----------	0.24			
	38-60	3-15	1.20-1.50	0.6-6.0	0.07-0.20	5.6-8.4	Low-----------	0.24			
30-----------------	0-11	5-18	1.10-1.40	0.6-6.0	0.15-0.22	5.6-7.8	Low-----------	0.28	5	3	3-10
Lamson	11-30	5-18	1.25-1.55	0.6-6.0	0.12-0.17	6.1-8.4	Low-----------	0.20			
	30-60	1-10	1.45-1.65	0.6-6.0	0.02-0.04	6.1-8.4	Low-----------	0.20			
33A----------------	0-27	2-15	1.25-1.41	2.0-6.0	0.10-0.13	5.6-7.3	Low-----------	0.17	5	2	1-4
Thetford	27-38	8-18	1.35-1.45	2.0-6.0	0.08-0.13	5.6-7.8	Low-----------	0.17			
	38-60	0-10	1.25-1.50	6.0-20	0.05-0.08	7.4-8.4	Low-----------	0.17			
34-----------------	0-12	3-12	0.90-1.60	6.0-20	0.10-0.12	6.1-7.8	Low-----------	0.17	5	2	.5-3
Belleville	12-33	2-12	1.45-1.70	6.0-20	0.06-0.10	6.1-8.4	Low-----------	0.17			
	33-60	25-35	1.45-1.95	0.2-0.6	0.14-0.20	7.4-8.4	Moderate-----	0.32			
35B----------------	0-9	3-8	1.45-1.60	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	.5-2
Metea	9-22	2-10	1.50-1.70	6.0-20	0.06-0.11	5.1-6.5	Low-----------	0.17			
	22-28	25-35	1.50-1.70	0.6-2.0	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	28-60	20-30	1.40-1.65	0.6-2.0	0.05-0.19	7.4-8.4	Low-----------	0.32			
36-----------------	0-26	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.8	--------------	----	2	2	55-75
Adrian	26-60	2-10	1.40-1.75	6.0-20	0.03-0.08	5.6-8.4	Low-----------	----			
39A----------------	0-9	10-18	1.40-1.70	0.6-2.0	0.18-0.24	6.1-7.8	Low-----------	0.32	5	6	1-3
Londo	9-22	20-35	1.40-1.80	0.2-2.0	0.14-0.19	6.6-7.8	Moderate-----	0.32			
	22-60	20-32	1.45-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.32			
40-----------------	0-9	10-20	1.10-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.28	5	5	1-4
Parkhill	9-35	18-35	1.45-1.80	0.2-0.6	0.15-0.19	6.1-7.8	Low-----------	0.28			
	35-60	12-25	1.46-1.95	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.28			
42-----------------	0-24	---	0.30-0.55	0.2-6.0	0.35-0.45	5.6-7.8	--------------	----	2	2	55-75
Edwards	24-60	---	---	---	---	7.4-8.4	--------------	----			
45B*:											
Guelph-----------	0-9	12-25	1.30-1.65	0.6-2.0	0.14-0.20	6.1-7.8	Low-----------	0.32	5	5	1-3
	9-25	18-35	1.30-1.70	0.6-2.0	0.14-0.18	6.1-7.8	Low-----------	0.32			
	25-60	18-32	1.30-1.80	0.6-2.0	0.14-0.18	7.9-8.4	Low-----------	0.32			
Londo------------	0-9	10-18	1.40-1.70	0.6-2.0	0.18-0.24	6.1-7.8	Low-----------	0.32	5	6	1-3
	9-22	20-35	1.40-1.80	0.2-2.0	0.14-0.19	6.6-7.8	Moderate-----	0.32			
	22-60	20-32	1.45-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.32			
47-----------------	0-8	0-15	1.35-1.50	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	1-4
Algansee	8-60	0-18	1.40-1.65	6.0-20	0.05-0.07	5.6-7.8	Low-----------	0.17			
49B, 49C, 49D-----	0-9	10-18	1.30-1.65	2.0-6.0	0.18-0.22	5.6-7.3	Low-----------	0.32	5	5	1-3
Marlette	9-40	18-30	1.30-1.70	0.2-0.6	0.18-0.20	5.6-7.8	Low-----------	0.32			
	40-60	15-25	1.30-1.70	0.2-0.6	0.12-0.19	7.9-8.4	Low-----------	0.32			
50A----------------	0-9	2-10	1.25-1.55	6.0-20	0.06-0.09	5.1-7.3	Low-----------	0.15	5	1	.5-1
Mecosta	9-20	2-12	1.25-1.60	6.0-20	0.03-0.10	5.1-7.3	Low-----------	0.15			
	20-24	5-12	1.25-1.60	6.0-20	0.06-0.10	5.1-7.3	Low-----------	0.10			
	24-60	0-10	1.50-1.65	>20	0.02-0.06	6.6-8.4	Low-----------	0.10			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
51*. Pits											
52*. Udorthents											
53*. Udipsamments											
54*: Histosols.											
Aquents.											
55A*: Urban land.											
Mecosta----------	0-9	2-10	1.25-1.55	6.0-20	0.06-0.09	5.1-7.3	Low----------	0.15	5	1	.5-1
	9-20	2-12	1.25-1.60	6.0-20	0.03-0.10	5.1-7.3	Low----------	0.15			
	20-24	5-12	1.25-1.60	6.0-20	0.06-0.10	5.1-7.3	Low----------	0.10			
	24-60	0-10	1.50-1.65	>20	0.02-0.06	6.6-8.4	Low----------	0.10			
56A*: Urban land.											
Thetford---------	0-27	2-15	1.25-1.41	2.0-6.0	0.10-0.13	5.6-7.3	Low----------	0.17	5	2	1-4
	27-38	8-18	1.35-1.45	2.0-6.0	0.08-0.13	5.6-7.8	Low----------	0.17			
	38-60	0-10	1.25-1.50	6.0-20	0.05-0.08	7.4-8.4	Low----------	0.17			
57A*: Urban land.											
Londo------------	0-9	10-18	1.40-1.70	0.6-2.0	0.18-0.24	6.1-7.8	Low----------	0.32	5	6	1-3
	9-22	20-35	1.40-1.80	0.2-2.0	0.14-0.19	6.6-7.8	Moderate-----	0.32			
	22-60	20-32	1.45-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.32			
60B, 60C--------- Guelph	0-9	12-25	1.30-1.65	0.6-2.0	0.14-0.20	6.1-7.8	Low----------	0.32	5	5	1-3
	9-25	18-35	1.30-1.70	0.6-2.0	0.14-0.18	6.1-7.8	Low----------	0.32			
	25-60	18-32	1.30-1.80	0.6-2.0	0.14-0.18	7.9-8.4	Low----------	0.32			
61A-------------- Selfridge	0-30	0-10	1.25-1.40	6.0-20	0.08-0.10	5.6-7.3	Low----------	0.15	5	1	1-3
	30-34	8-18	1.35-1.45	6.0-20	0.12-0.14	5.6-7.3	Low----------	0.15			
	34-60	18-35	1.50-1.90	0.2-0.6	0.10-0.14	7.4-8.4	Low----------	0.37			
62B, 62C, 62D---- Ormas	0-22	5-12	1.40-1.60	2.0-6.0	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	1-3
	22-33	18-25	1.50-1.60	2.0-6.0	0.11-0.14	5.6-7.8	Low----------	0.32			
	33-60	1-8	1.55-1.70	>20	0.03-0.05	7.4-8.4	Low----------	0.15			
63B*, 63C*, 63D*, 63E*:											
Remus----------	0-9	8-18	1.10-1.60	2.0-6.0	0.10-0.18	5.1-7.3	Low----------	0.28	3	3	1-2
	9-43	10-30	1.75-1.90	0.6-2.0	0.08-0.16	5.1-7.3	Low----------	0.28			
	43-60	15-30	1.30-1.80	0.6-2.0	0.08-0.16	5.1-7.3	Low----------	0.28			
Spinks---------	0-20	0-10	1.20-1.60	6.0-20	0.06-0.08	5.1-7.3	Low----------	0.17	5	1	2-4
	20-60	0-15	1.20-1.50	2.0-6.0	0.04-0.08	5.6-7.8	Low----------	0.17			
65B, 65C--------- Arkport	0-11	5-15	1.10-1.40	2.0-6.0	0.08-0.09	4.5-7.3	Low----------	0.17	3	---	.5-2
	11-23	3-15	1.25-1.55	2.0-6.0	0.06-0.16	4.5-7.3	Low----------	0.28			
	23-60	1-5	1.25-1.55	2.0-6.0	0.02-0.06	5.6-8.4	Low----------	0.28			
66B*, 66C*: Woodbeck---------	0-8	15-27	1.50-1.80	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.32	4	6	1-3
	8-24	35-50	1.55-1.80	0.2-0.6	0.10-0.20	5.6-7.8	Moderate-----	0.32			
	24-60	0-10	1.40-1.55	6.0-20	0.02-0.07	6.1-8.4	Low----------	0.15			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
66B*, 66C*:											
Coloma----------	0-41	1-9	1.35-1.65	6.0-20	0.06-0.09	5.1-6.0	Low----------	0.15	5	1	<1
	41-60	1-10	1.50-1.65	6.0-20	0.03-0.08	5.1-6.5	Low----------	0.15			
67B, 67C, 67D---- Remus	0-9	8-18	1.10-1.60	2.0-6.0	0.10-0.18	5.1-7.3	Low----------	0.28	3	3	1-2
	9-43	10-30	1.75-1.90	0.6-2.0	0.08-0.16	5.1-7.3	Low----------	0.28			
	43-60	15-30	1.30-1.80	0.6-2.0	0.08-0.16	5.1-7.3	Low----------	0.28			
70B*:											
Ithaca----------	0-10	8-27	1.40-1.70	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.32	5	6	1-4
	10-30	35-50	1.40-1.65	0.2-0.6	0.10-0.20	5.1-7.8	Moderate-----	0.32			
	30-60	30-50	1.50-1.65	0.2-0.6	0.13-0.20	7.9-8.4	Moderate-----	0.32			
Selfridge-------	0-30	0-10	1.25-1.40	6.0-20	0.08-0.10	5.6-7.3	Low----------	0.15	5	1	1-3
	30-34	8-18	1.35-1.45	6.0-20	0.12-0.14	5.6-7.3	Low----------	0.15			
	34-60	18-35	1.50-1.90	0.2-0.6	0.10-0.14	7.4-8.4	Low----------	0.37			
71--------------- Cohoctah	0-13	5-20	1.20-1.60	2.0-6.0	0.13-0.22	6.1-7.8	Low----------	0.28	5	3	1-4
	13-35	5-27	1.45-1.65	2.0-6.0	0.12-0.20	6.1-8.4	Low----------	0.28			
	35-60	5-10	1.40-1.55	6.0-20	0.04-0.08	6.1-8.4	Low----------	0.28			
74--------------- Shoals	0-9	18-27	1.30-1.50	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.37	5	5	2-5
	9-40	18-33	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.8	Low----------	0.37			
	40-60	12-25	1.35-1.60	0.6-2.0	0.12-0.21	6.6-8.4	Low----------	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "brief," "apparent," and "perched" are explained in the text. The more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action	Ri
		Frequency	Duration	Months	Depth	Kind	Months	Total		Unc s
					Ft			In		
10*: Pinnebog	A/D	None	---	---	+1-1.0	Apparent	Oct-Jul	36-46	High	Mod
11B, 11C, 11D: Spinks	A	None	---	---	>6.0	---	---	---	Low	Low
12B, 12C, 12D, 12E, 12F: Coloma	A	None	---	---	>6.0	---	---	---	Low	Low
14B, 14C: Tekenink	B	None	---	---	>6.0	---	---	---	Moderate	Low
15B, 15C, 15D: Plainfield	A	None	---	---	>6.0	---	---	---	Low	Low
16A: Wasepi	B	None	---	---	1.0-2.0	Apparent	Nov-May	---	High	Mod
17: Cohoctah	B/D	Frequent	Brief to long.	Nov-Apr	0-1.0	Apparent	Sep-May	---	High	Hig
18B: Covert	A	None	---	---	2.0-3.5	Apparent	Nov-Apr	---	Low	Low
19*: Gilford	B/D	None	---	---	+.5-1.0	Apparent	Dec-May	---	High	Hig
20A: Pipestone	B	None	---	---	0.5-1.5	Apparent	Oct-Jun	---	Moderate	Low
21*: Kingsville	A/D	None	---	---	+1-1.0	Apparent	Jan-Apr	---	Moderate	Hig
22B, 22C, 22D: Perrinton	C	None	---	---	>6.0	---	---	---	Moderate	Hig
23B: Ithaca	C	None	---	---	1.0-2.0	Perched	Oct-May	---	High	Hig
24*: Ziegenfuss	D	None	---	---	+1-1.0	Apparent	Nov-May	---	High	Hig
25B: Wixom	B	None	---	---	0.5-1.5	Perched	Nov-Jun	---	Moderate	Mod
26A: Metamora	B	None	---	---	1.0-2.0	Apparent	Nov-May	---	High	Mod
27*: Corunna	B/D	None	---	---	+1-1.0	Apparent	Nov-May	---	High	Hig

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action	U
		Frequency	Duration	Months	Depth	Kind	Months	Total		
					Ft			In		
29A----- Minoa	C	None-----	---	---	0.5-1.5	Apparent	Feb-Apr	---	High-----	M
30*----- Lamson	B/D	None-----	---	---	+1-0.5	Apparent	Dec-May	---	High-----	H
33A----- Thetford	A	None-----	---	---	1.0-2.0	Apparent	Feb-May	---	Moderate	L
34*----- Belleville	B/D	None-----	---	---	+1-1.0	Apparent	Nov-May	---	High-----	H
35B----- Metea	B	None-----	---	---	>6.0	---	---	---	Moderate	M
36*----- Adrian	A/D	None-----	---	---	+1-1.0	Apparent	Nov-May	29-33	High-----	H
39A----- Londo	C	None-----	---	---	1.0-2.0	Apparent	Nov-May	---	High-----	H
40*----- Parkhill	B/D	None-----	---	---	+1-1.0	Apparent	Nov-May	---	High-----	H
42*----- Edwards	B/D	None-----	---	---	+1-0.5	Apparent	Sep-Jun	25-30	High-----	H
45B:										
Guelph-----	B	None-----	---	---	>6.0	---	---	---	Moderate	M
Londo-----	C	None-----	---	---	1.0-2.0	Apparent	Nov-May	---	High-----	H
47----- Algansee	B	Occasional	Long-----	Nov-May	1.0-2.0	Apparent	Nov-May	---	Moderate	L
49B, 49C, 49D----- Marlette	B	None-----	---	---	>6.0	---	---	---	Moderate	L
50A----- Mecosta	A	None-----	---	---	>6.0	---	---	---	Low-----	L
51. Pits										
52. Udorthents										
53. Udipsamments										
54: Histosols.										
Aquents.										

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action	R
		Frequency	Duration	Months	Depth	Kind	Months	Total		Un
					Ft			In		
55A:										
Urban land.										
Mecosta	A	None	---	---	>6.0	---	---	---	Low	Lo
56A:										
Urban land.										
Thetford	A	None	---	---	1.0-2.0	Apparent	Feb-May	---	Moderate	Lo
57A:										
Urban land.										
Londo	C	None	---	---	1.0-2.0	Apparent	Nov-May	---	High	Hi
60B, 60C Guelph	B	None	---	---	>6.0	---	---	---	Moderate	Mo
61A Selfridge	B	None	---	---	1.0-2.0	Perched	Nov-May	---	High	Hi
62B, 62C, 62D Ormas	B	None	---	---	>6.0	---	---	---	Moderate	Lo
63B, 63C, 63D, 63E:										
Remus	B	None	---	---	>6.0	---	---	---	Moderate	Lo
Spinks	A	None	---	---	>6.0	---	---	---	Low	Lo
65B, 65C Arkport	B	None	---	---	>6.0	---	---	---	Moderate	Lo
66B, 66C:										
Woodbeck	B	None	---	---	>6.0	---	---	---	Moderate	Hi
Coloma	A	None	---	---	>6.0	---	---	---	Low	Lo
67B, 67C, 67D Remus	B	None	---	---	>6.0	---	---	---	Moderate	Lo
70B:										
Ithaca	C	None	---	---	1.0-2.0	Perched	Oct-May	---	High	Hi
Selfridge	B	None	---	---	1.0-2.0	Perched	Nov-May	---	High	Hi
71 Cohoctah	B/D	Occasional	Brief to long.	Nov-Apr	0-1.0	Apparent	Sep-May	---	High	Hi
74 Shoals	C	Occasional	Brief	Oct-Jun	0.5-1.5	Apparent	Jan-Apr	---	High	Hi

* In the "High water table--Depth" column, a plus sign preceding the range in depth indicates that the water t the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. Th indicates the depth below the surface.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Algansee	Mixed, mesic Aquic Udipsamments
Aquents	Mixed, nonacid, mesic Aquents
Arkport	Coarse-loamy, mixed, mesic Psammentic Hapludalfs
Belleville	Sandy over loamy, mixed, mesic Typic Haplaquolls
Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Coloma	Mixed, mesic Alfic Udipsamments
Corunna	Coarse-loamy, mixed, mesic Typic Haplaquolls
Covert	Sandy, mixed, mesic Entic Haplorthods
Edwards	Marly, euic, mesic Limnic Medisaprists
Gilford	Coarse-loamy, mixed, mesic Typic Haplaquolls
Guelph	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Histosols	Euic, mesic Histosols
Ithaca	Fine, mixed, mesic Glossaquic Hapludalfs
Kingsville	Mixed, mesic Mollic Psammaquents
*Lamson	Coarse-loamy, mixed, nonacid, mesic Aeric Haplaquepts
*Londo	Fine-loamy, mixed, mesic Aeric Glossaqualfs
Marlette	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Mecosta	Sandy-skeletal, mixed, mesic Typic Udorthents
Metamora	Fine-loamy, mixed, mesic Udollic Ochraqualfs
*Metea	Loamy, mixed, mesic Arenic Hapludalfs
Minoa	Coarse-loamy, mixed, mesic Aquic Dystric Eutrochrepts
*Ormas	Loamy, mixed, mesic Arenic Hapludalfs
Parkhill	Fine-loamy, mixed, nonacid, mesic Mollic Haplaquepts
Perrinton	Fine, mixed, mesic Glossoboric Hapludalfs
Pinnebog	Euic, mesic Hemic Medisaprists
*Pipestone	Sandy, mixed, mesic Entic Haplaquods
Plainfield	Mixed, mesic Typic Udipsamments
*Remus	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Selfridge	Loamy, mixed, mesic Aquic Arenic Hapludalfs
*Shoals	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Spinks	Sandy, mixed, mesic Psammentic Hapludalfs
Tekenink	Coarse-loamy, mixed, mesic Glossoboric Hapludalfs
Thetford	Sandy, mixed, mesic Psammaquentic Hapludalfs
Udipsamments	Mixed, mesic Udipsamments
Udorthents	Loamy, mixed, mesic Udorthents
Wasepi	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Wixom	Sandy over loamy, mixed, mesic Alfic Haplaquods
Woodbeck	Clayey over sandy or sandy-skeletal, mixed, mesic Glossoboric Hapludalfs
Ziegenfuss	Fine, mixed, nonacid, mesic Mollic Haplaquepts

* The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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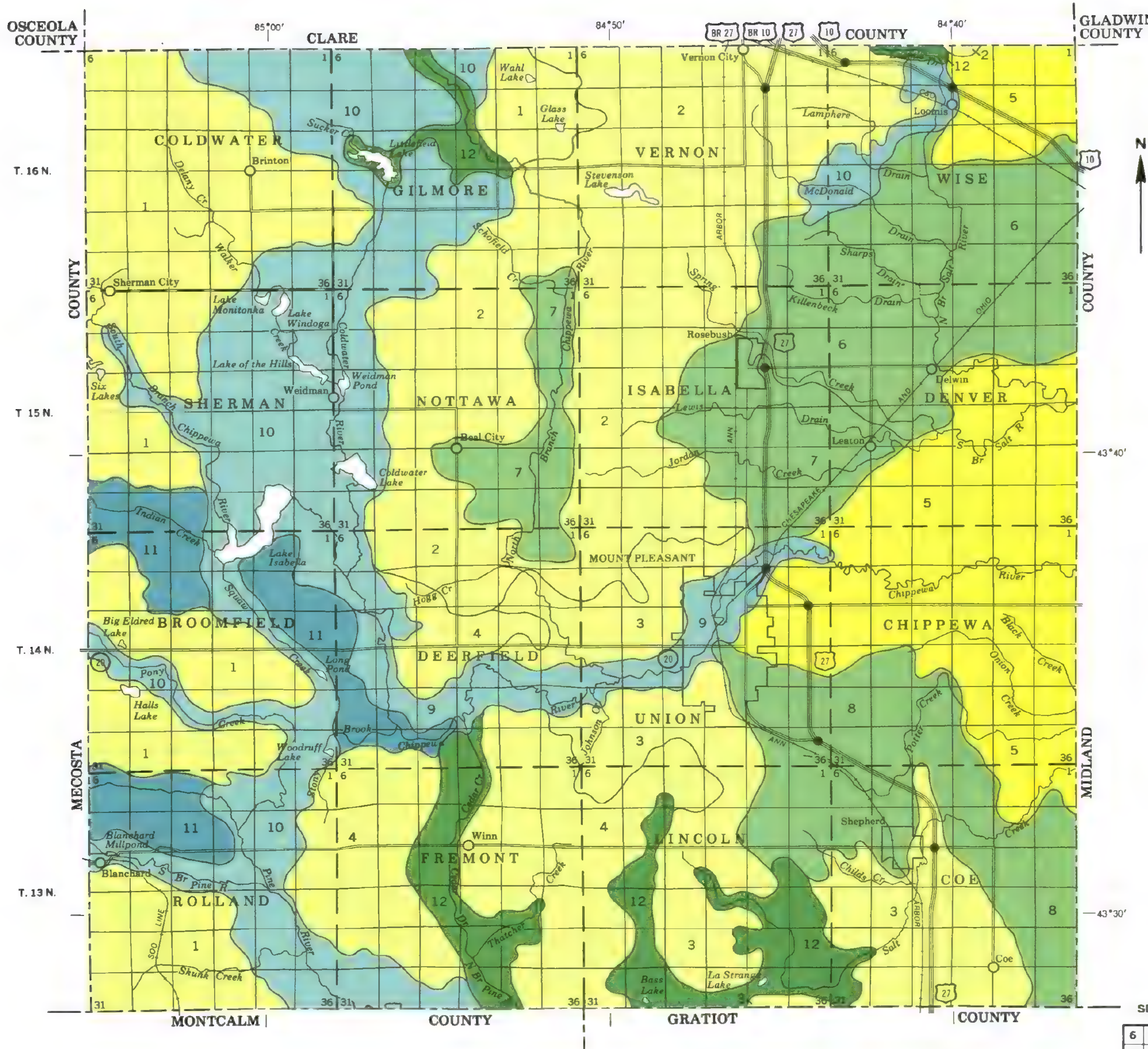


Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

LEGEND*

NEARLY LEVEL TO ROLLING, WELL DRAINED TO POORLY DRAINED SOILS

1 — Remus-Spinks Association: Nearly level to gently rolling, well drained loamy and sandy soils; on moraines and outwash plains

2 — Perrinton-Ithaca Association: Nearly level to gently rolling, well drained and somewhat poorly drained loamy soils; on moraines and till plains

3 — Guelph-Londo-Parkhill Association: Nearly level to gently rolling, well drained, somewhat poorly drained, and poorly drained loamy soils; on moraines and till plains

4 — Marlette-Spinks Association: Nearly level to rolling, well drained loamy and sandy soils; on moraines and till plains

NEARLY LEVEL, SOMEWHAT POORLY DRAINED AND POORLY DRAINED SOILS

5 — Pipestone-Kingsville Association: Nearly level, somewhat poorly drained and poorly drained sandy soils; on glacial deltas, till plains, outwash plains, and beach ridges

NEARLY LEVEL AND UNDULATING, SOMEWHAT POORLY DRAINED AND POORLY DRAINED SOILS

6 — Londo-Parkhill-Wixom Association: Nearly level and undulating, somewhat poorly drained and poorly drained loamy and sandy soils; on till plains, outwash plains, and beach ridges

7 — Ithaca-Ziegenfuss Association: Nearly level and undulating, somewhat poorly drained and poorly drained loamy soils; on till plains

8 — Londo-Parkhill Association: Nearly level, somewhat poorly drained and poorly drained loamy soils; on till plains

NEARLY LEVEL TO HILLY, SOMEWHAT EXCESSIVELY DRAINED, POORLY DRAINED, AND VERY POORLY DRAINED SOILS

9 — Mecosta-Cohoctah Association: Nearly level, somewhat excessively drained and poorly drained sandy and loamy soils; on stream terraces, outwash plains, and flood plains

10 — Coloma-Pinnebog Association: Nearly level to hilly, somewhat excessively drained and very poorly drained sandy and mucky soils; on outwash plains and in upland drains and depressions

NEARLY LEVEL TO STEEP, SOMEWHAT EXCESSIVELY DRAINED AND WELL DRAINED SOILS

11 — Coloma-Remus Association: Nearly level to steep, somewhat excessively drained and well drained sandy and loamy soils; on moraines, till plains, and kames

NEARLY LEVEL TO GENTLY ROLLING, VERY POORLY DRAINED, SOMEWHAT POORLY DRAINED AND WELL DRAINED SOILS

12 — Adrian-Thetford-Spinks Association: Nearly level to gently rolling, very poorly drained, somewhat poorly drained, and well drained mucky and sandy soils; in upland drains and depressions and on outwash plains

*The texture given in the descriptive heading of each association refers to the surface layer of the major soils in that association.

Compiled 1984

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MICHIGAN DEPARTMENT OF AGRICULTURE
MICHIGAN AGRICULTURAL EXPERIMENT STATION
MICHIGAN TECHNOLOGICAL UNIVERSITY

GENERAL SOIL MAP

ISABELLA COUNTY, MICHIGAN

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
10	Pinnebog muck
11B	Spinks sand, 0 to 6 percent slopes
11C	Spinks sand, 6 to 12 percent slopes
11D	Spinks sand, 12 to 18 percent slopes
12B	Coloma sand, 0 to 6 percent slopes
12C	Coloma sand, 6 to 12 percent slopes
12D	Coloma sand, 12 to 18 percent slopes
12E	Coloma sand, 18 to 25 percent slopes
12F	Coloma sand, 25 to 45 percent slopes
14B	Tekenink loamy fine sand, 2 to 6 percent slopes
14C	Tekenink loamy fine sand, 6 to 12 percent slopes
15B	Plainfield sand, 0 to 6 percent slopes
15C	Plainfield sand, 6 to 12 percent slopes
15D	Plainfield sand, 12 to 18 percent slopes
16A	Wasepi loamy sand, 0 to 3 percent slopes
17	Cohoctah fine sandy loam, frequently flooded
18B	Covert sand, 0 to 4 percent slopes
19	Gilford fine sandy loam
20A	Pipestone sand, 0 to 3 percent slopes
21	Kingsville loamy sand
22B	Perrinton loam, 2 to 6 percent slopes
22C	Perrinton loam, 6 to 12 percent slopes
22D	Perrinton loam, 12 to 18 percent slopes
23B	Ithaca loam, 0 to 4 percent slopes
24	Ziegenfuss loam
25B	Wixom loamy sand, 0 to 4 percent slopes
26A	Metamora fine sandy loam, 0 to 3 percent slopes
27	Corunna sandy loam
29A	Minoa loamy fine sand, 0 to 3 percent slopes
30	Lamson fine sandy loam
33A	Thetford loamy sand, 0 to 3 percent slopes
34	Belleville loamy sand
35B	Metea loamy sand, 1 to 6 percent slopes
36	Adrian muck
39A	Londo loam, 0 to 3 percent slopes
40	Parkhill loam
42	Edwards muck
45B	Guelph-Londo loams, 1 to 6 percent slopes
47	Algansee loamy sand
49B	Marlette loam, 2 to 6 percent slopes
49C	Marlette loam, 6 to 12 percent slopes
49D	Marlette loam, 12 to 20 percent slopes
50A	Mecosta sand, 0 to 3 percent slopes
51	Pits, gravel
52	Udorthents, loamy
53	Udipsamments, nearly level
54	Histosols and Aquents, ponded
55A	Urban land-Mecosta complex, 0 to 3 percent slopes
56A	Urban land-Thetford complex, 0 to 3 percent slopes
57A	Urban land-Londo complex, 0 to 3 percent slopes
60B	Guelph loam, 2 to 6 percent slopes
60C	Guelph loam, 6 to 12 percent slopes
61A	Selfridge sand, 0 to 3 percent slopes
62B	Ormas sand, 0 to 6 percent slopes
62C	Ormas sand, 6 to 12 percent slopes
62D	Ormas sand, 12 to 18 percent slopes
63B	Remus-Spinks complex, 1 to 6 percent slopes
63C	Remus-Spinks complex, 6 to 12 percent slopes
63D	Remus-Spinks complex, 12 to 18 percent slopes
63E	Remus Spinks complex, 18 to 35 percent slopes
65B	Arkport loamy fine sand, 1 to 6 percent slopes
65C	Arkport loamy fine sand, 6 to 12 percent slopes
66B	Woodbeck-Coloma complex, 1 to 6 percent slopes
66C	Woodbeck-Coloma complex, 6 to 12 percent slopes
67B	Remus sandy loam, 1 to 6 percent slopes
67C	Remus sandy loam, 6 to 12 percent slopes
67D	Remus sandy loam, 12 to 18 percent slopes
70B	Ithaca-Selfridge complex, 0 to 4 percent slopes
71	Cohoctah fine sandy loam, occasionally flooded
74	Shoals silt loam

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Hedley Airstrip

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water

PITS — w

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 40, 49B

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

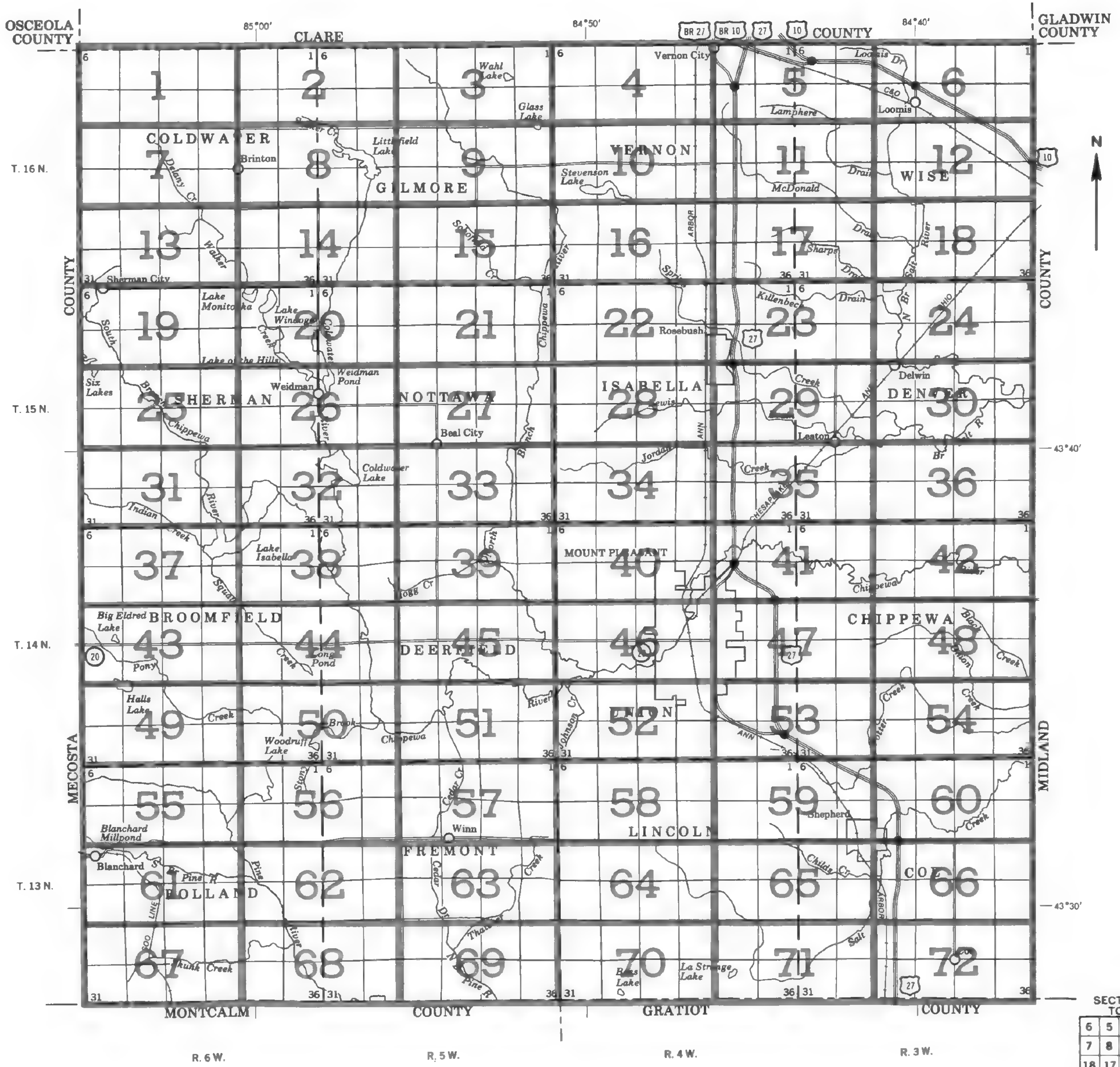
GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Loamy spot in sandy area < 3 acres
- Marl spot < 3 acres
- Organic soil in mineral area < 3 acres

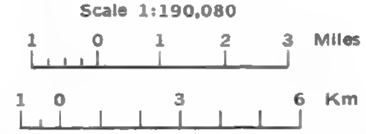


SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

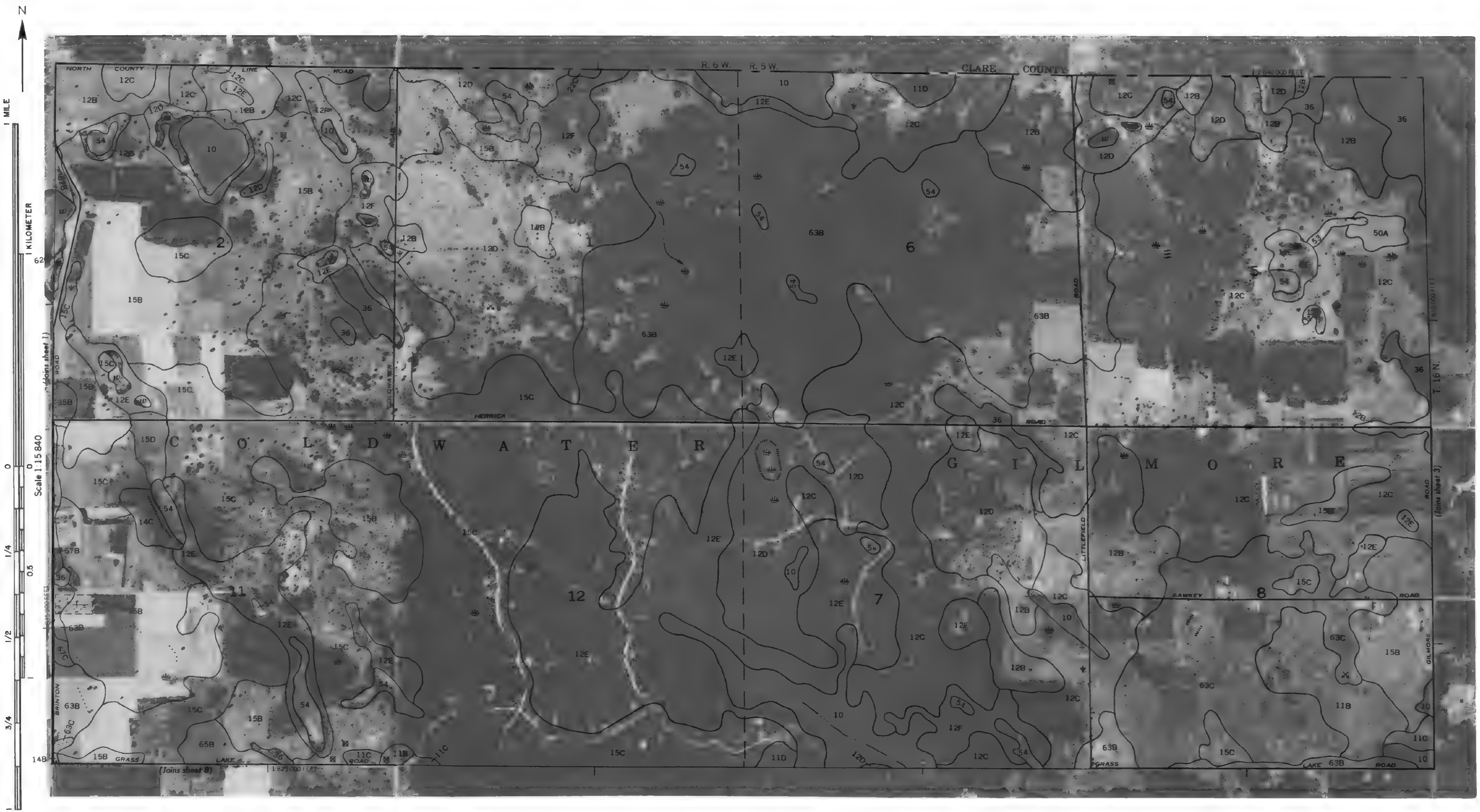
INDEX TO MAP SHEETS
ISABELLA COUNTY, MICHIGAN

Scale 1:190,080




1
N
R. 6 W.
CLARE COUNTY
COUNTY LINE ROAD
1 805 000 FEET
MECOSTA COUNTY
T. 16 N.
C O L D W A T E R
Russell Lake
HERRICK ROAD
BAWKEY ROAD
GRASS LAKE ROAD
SHERMAN
WYMAN
ROLLAND
BRINTON
(Joins sheet 2)
(Joins sheet 7)
1 820 000 FEET
6
5
4
3
7
8
9
10
1 MILE
1 KILOMETER
Scale 1:15 840

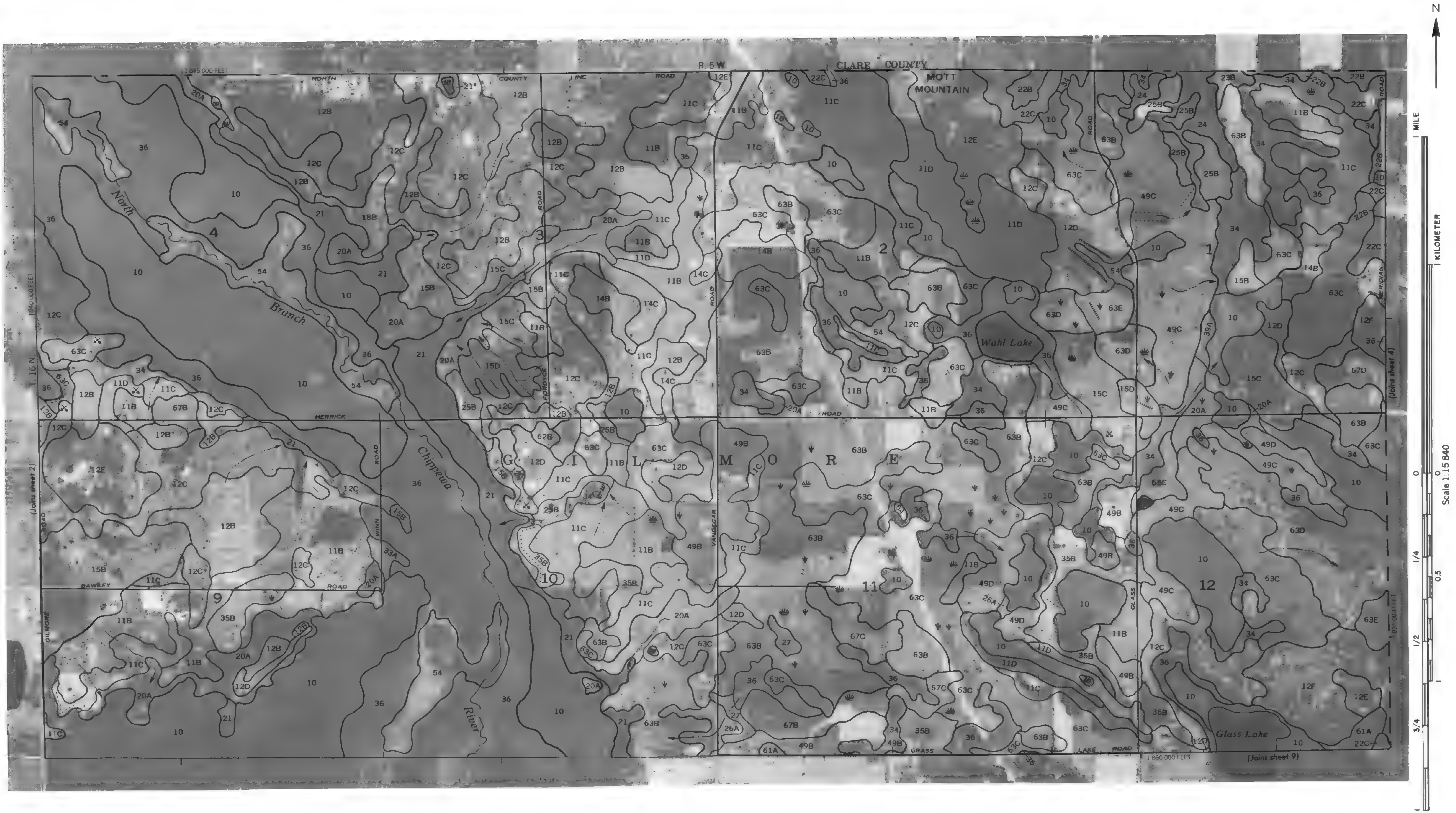
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 2



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners if shown are approximately positioned.

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 3

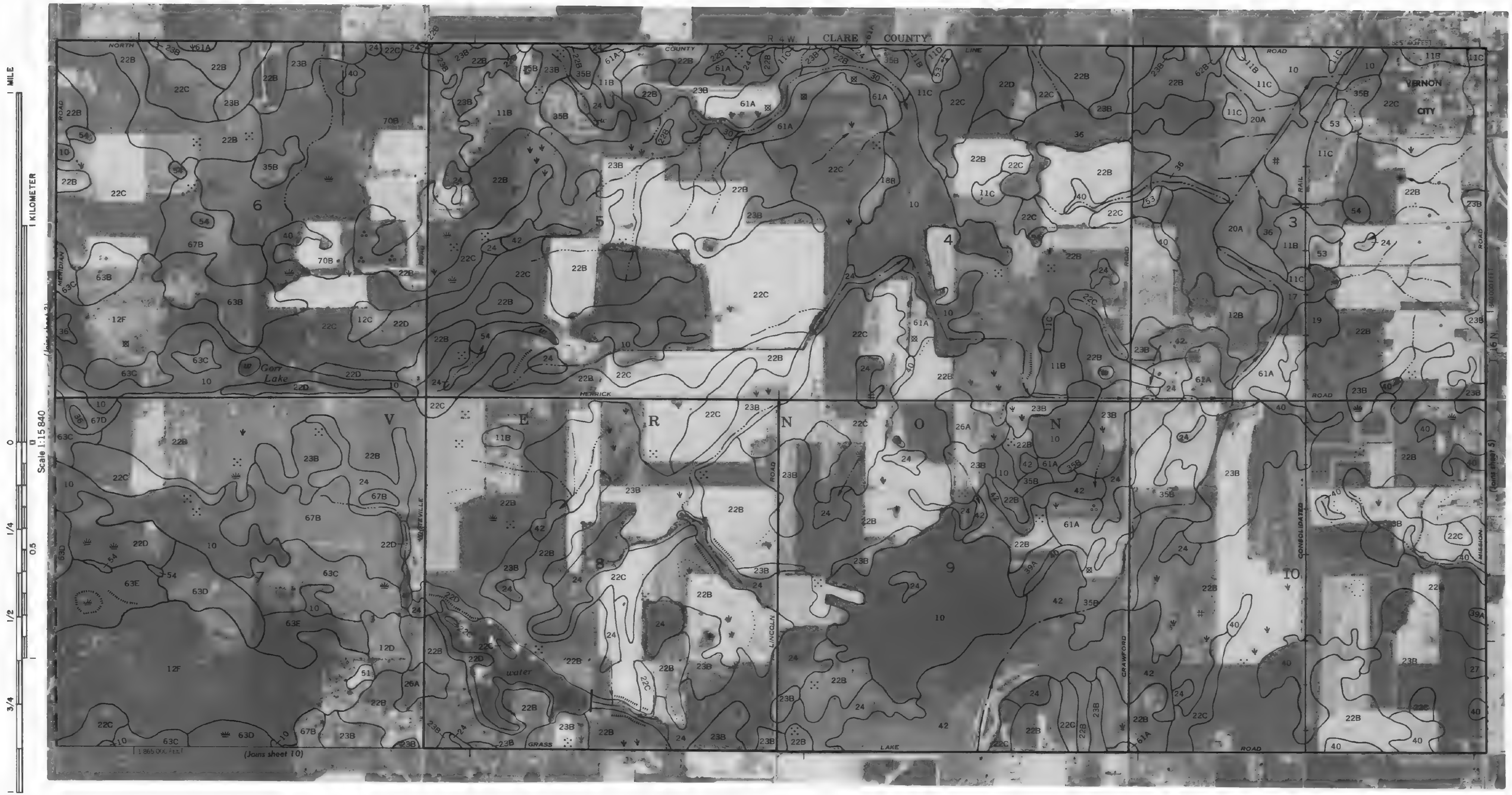
3



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 4



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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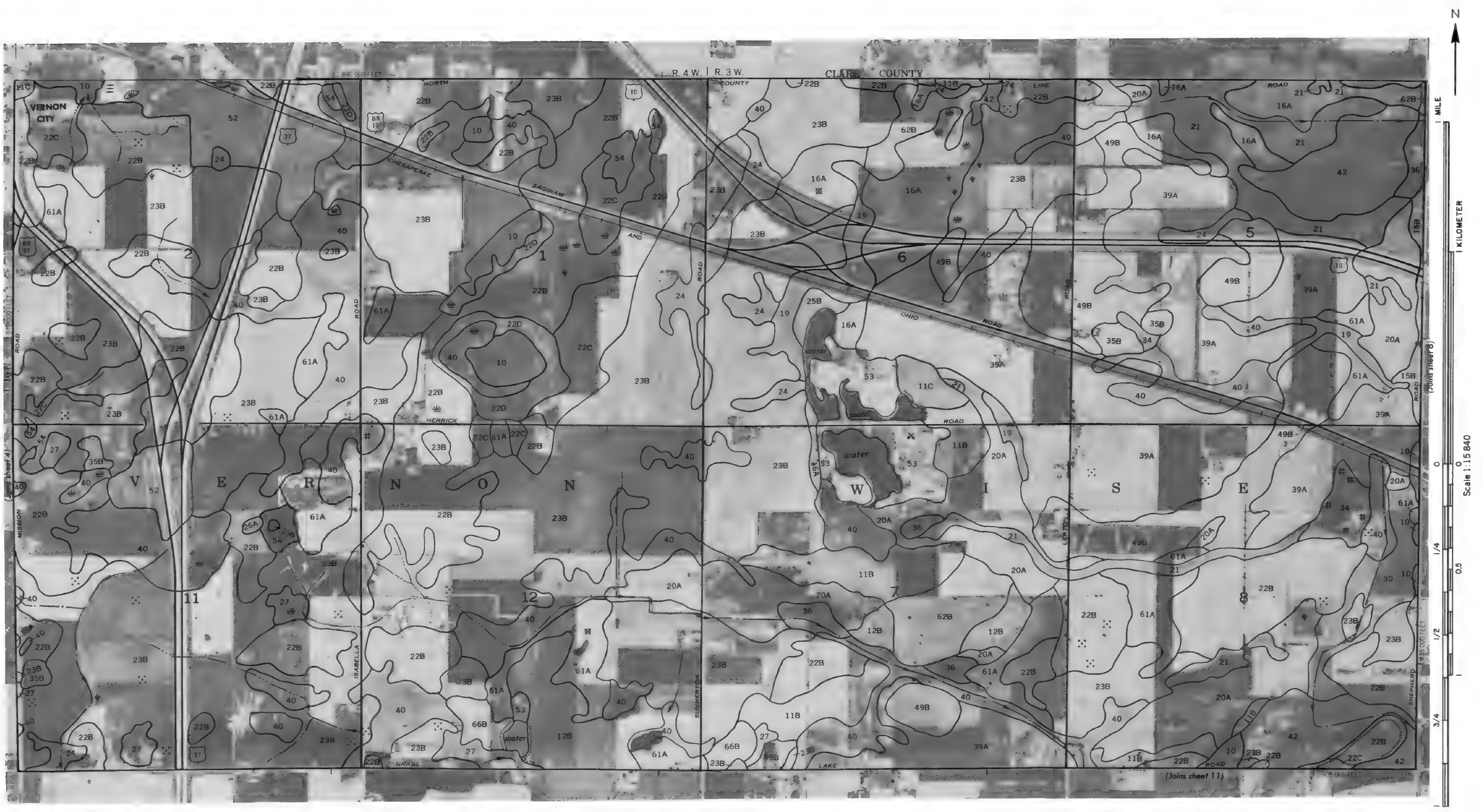

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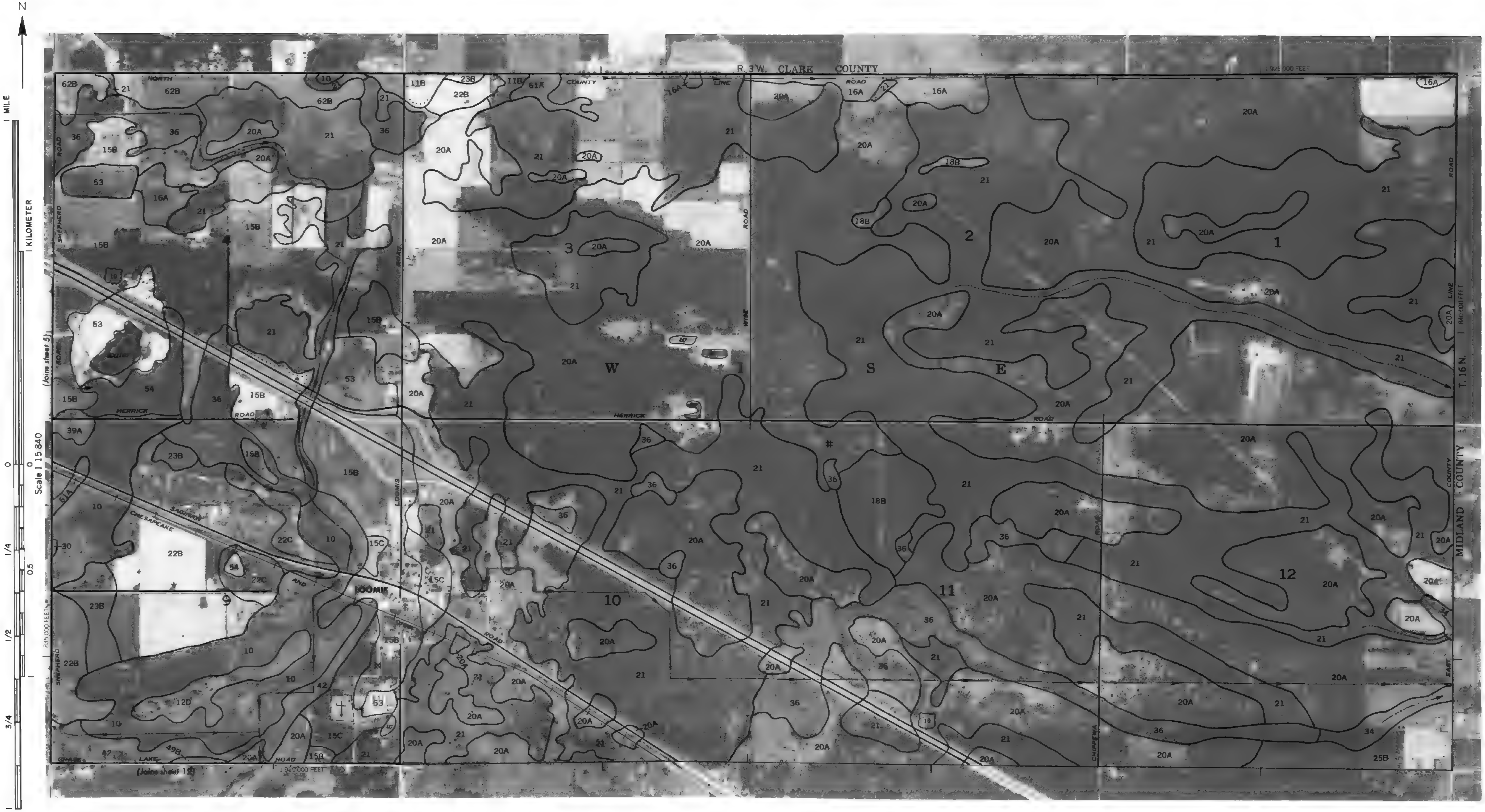
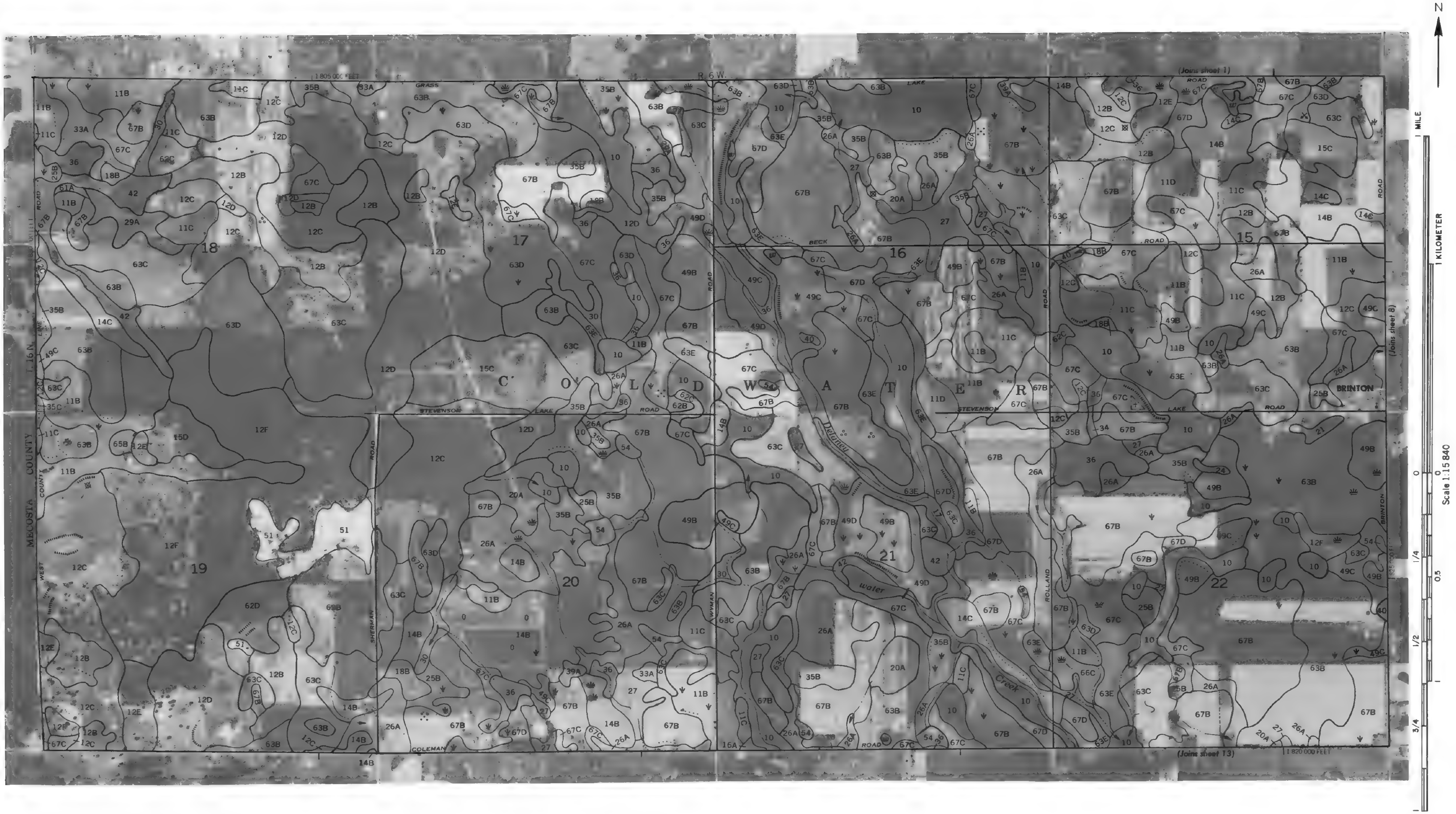
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 6



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 7



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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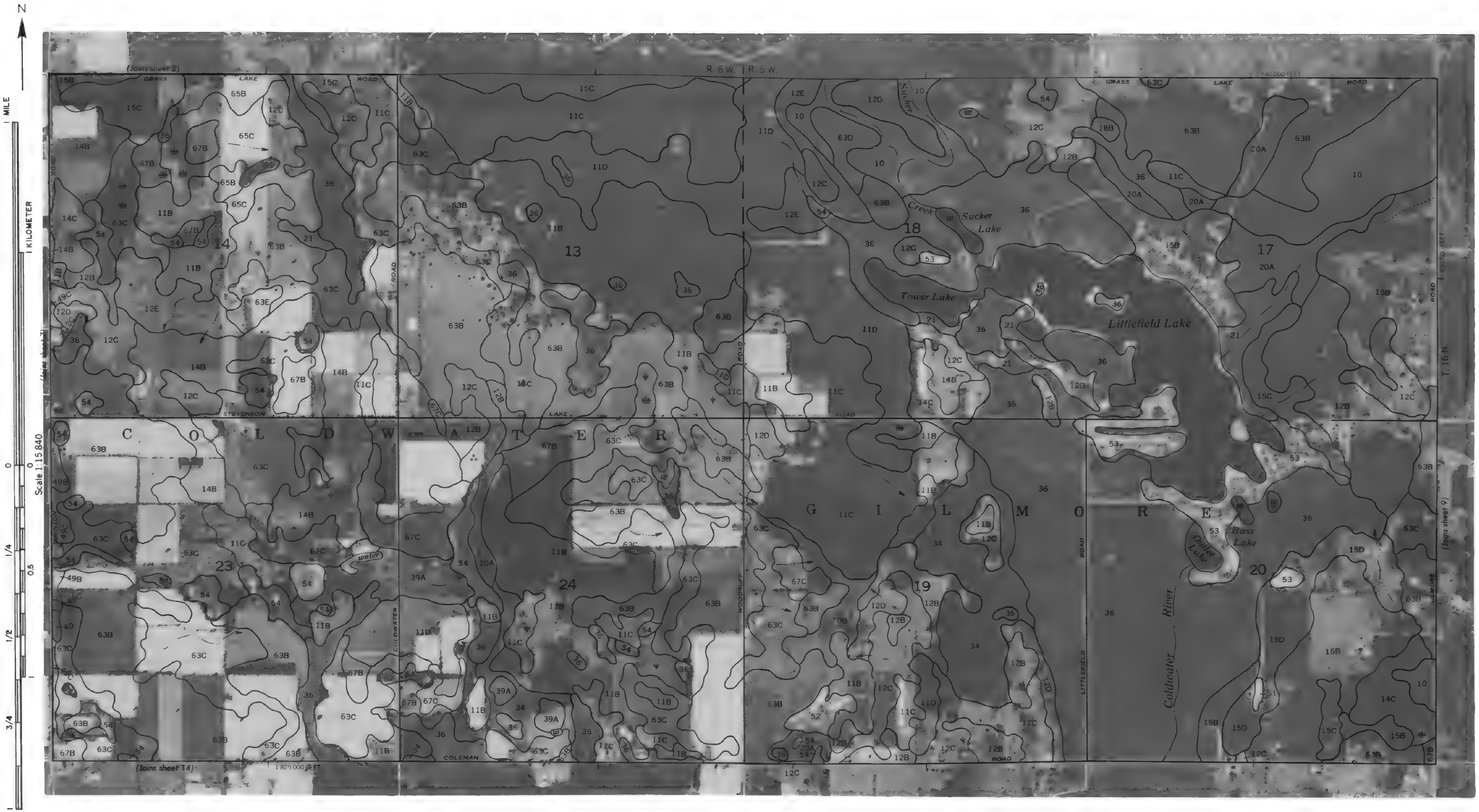
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 8



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 10

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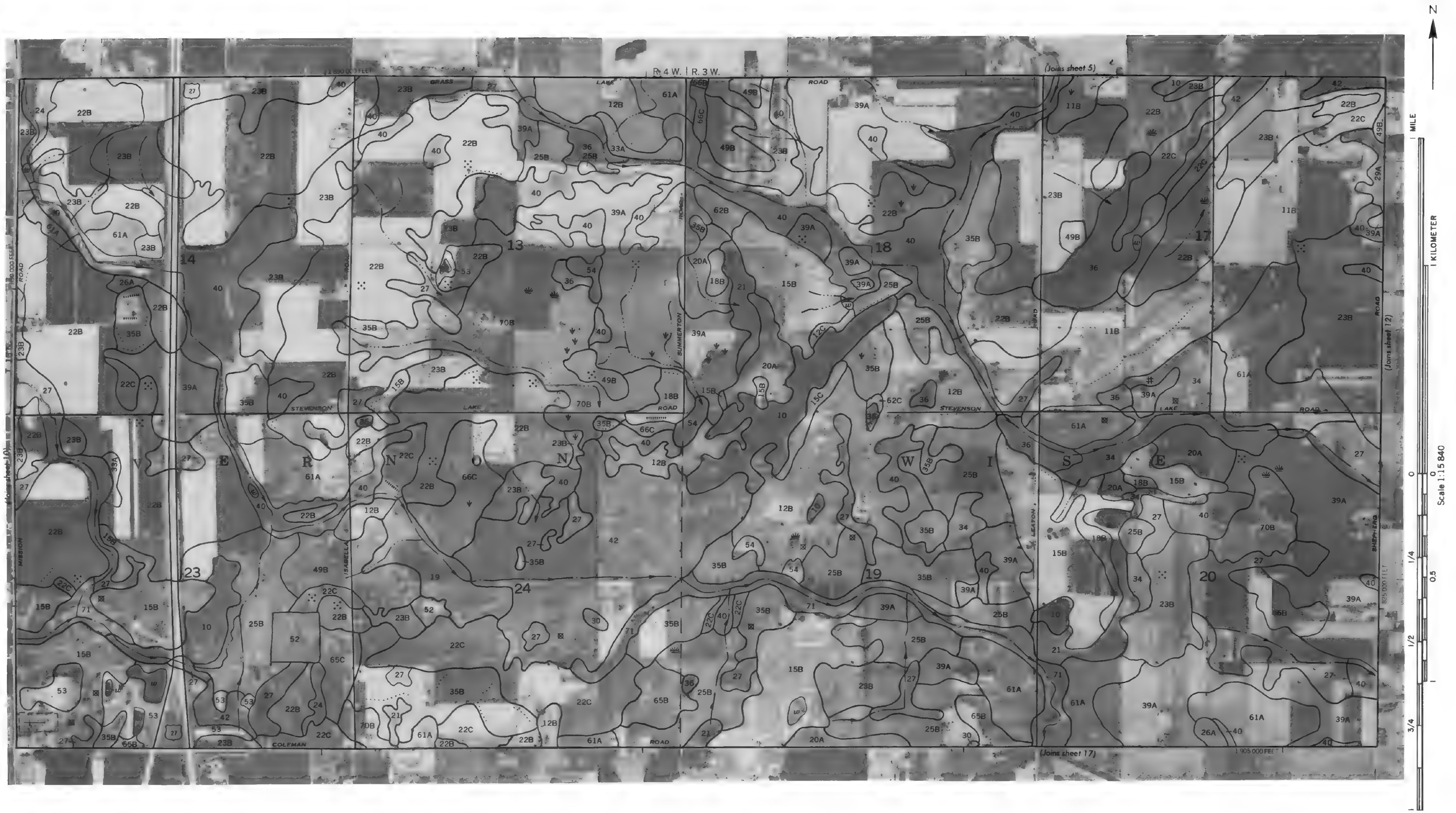
11
N
(Joins sheet 5)
(Joins sheet 17)
(Joins sheet 12)
(Joins sheet 10)
R. 4 W. | R. 3 W.
GRASS LAKE ROAD
STEVENSON LAKE ROAD
COLEMAN ROAD
MISSION ROAD
ISABELLA ROAD
SUMMERTON ROAD
LEATON ROAD
SHEPHERD ROAD
V E R N O N
W I S E
13
14
17
18
19
20
23
24
1 MILE
1 KILOMETER
Scale 1:15 840
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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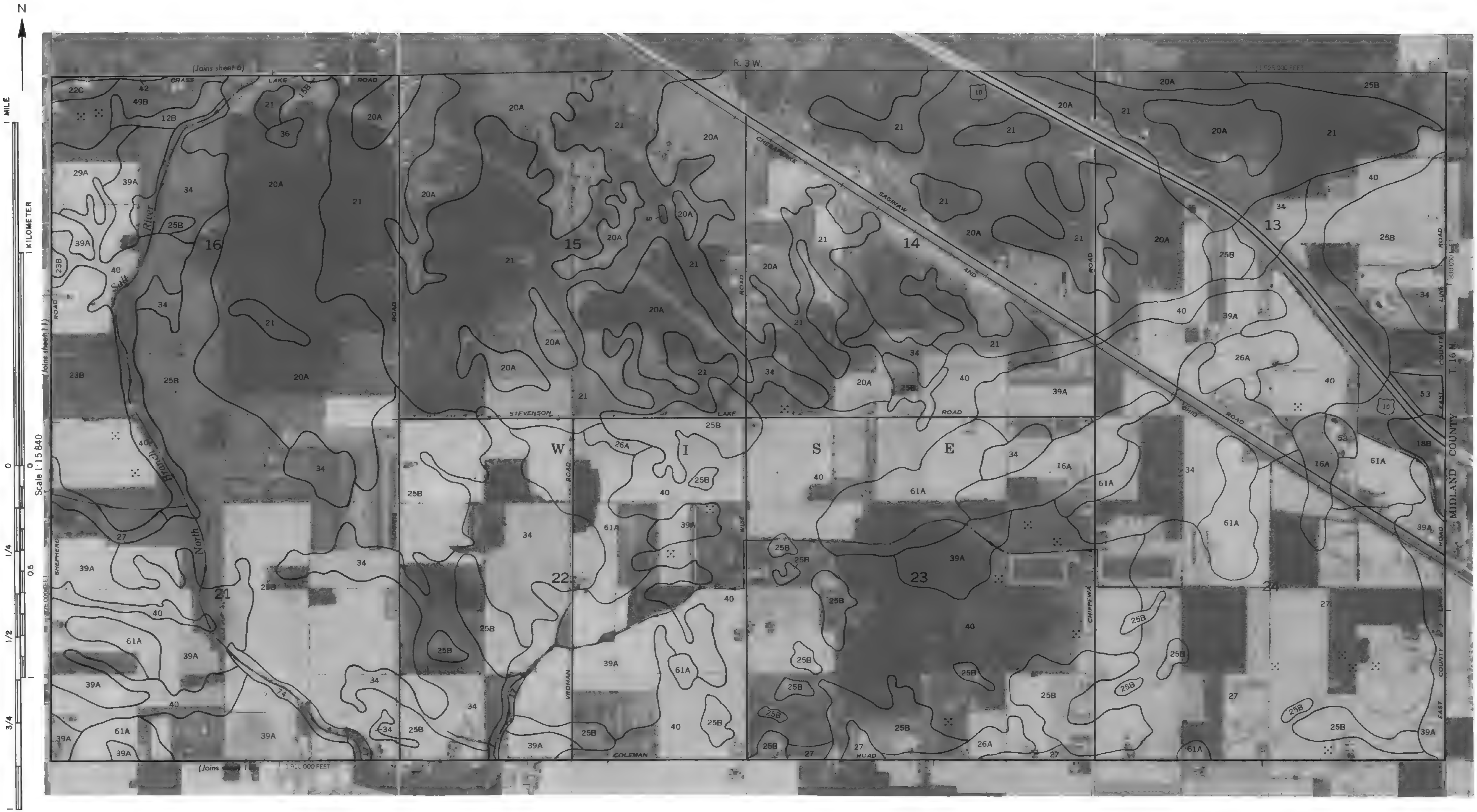

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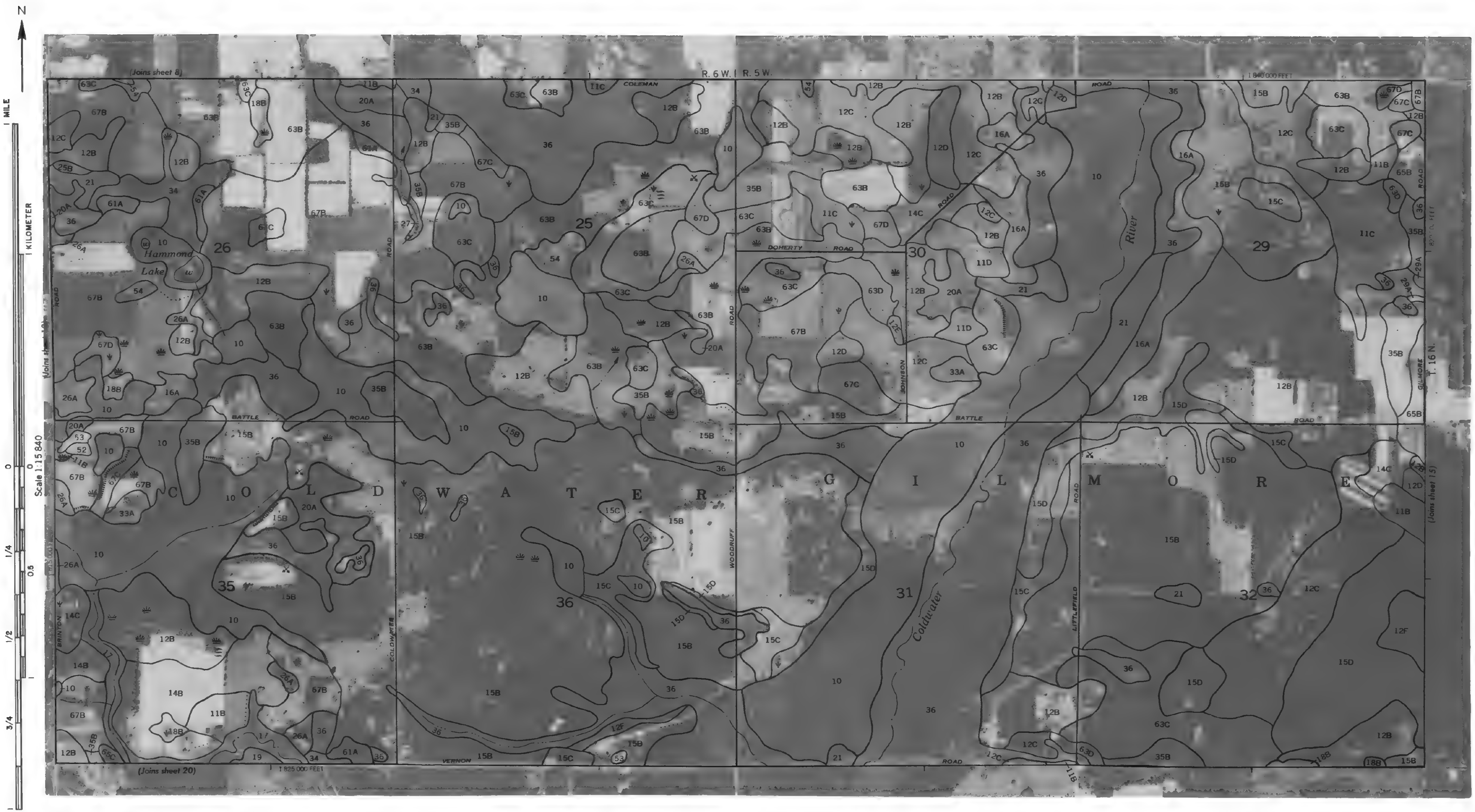
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 14



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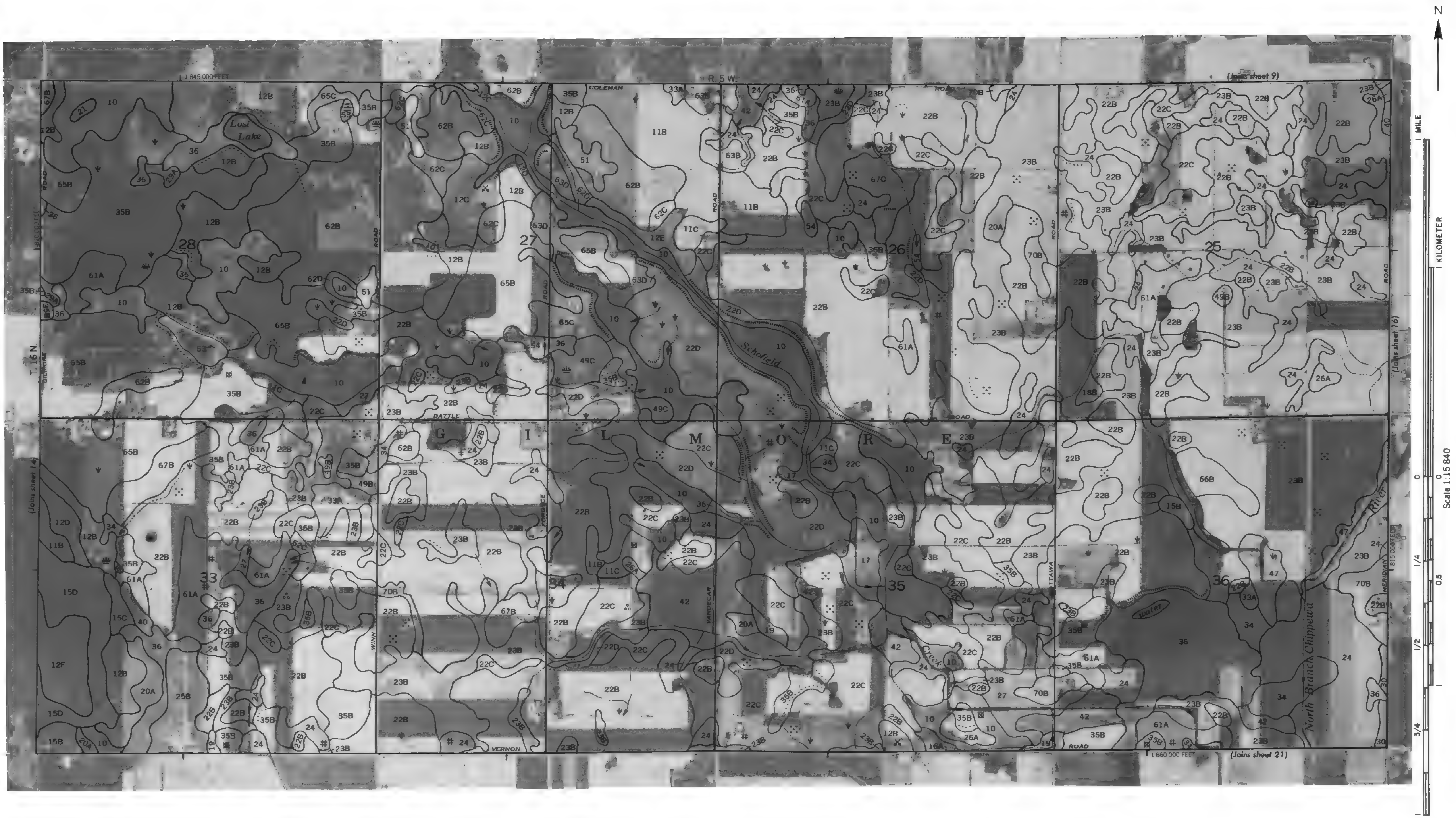
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 15



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SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 16

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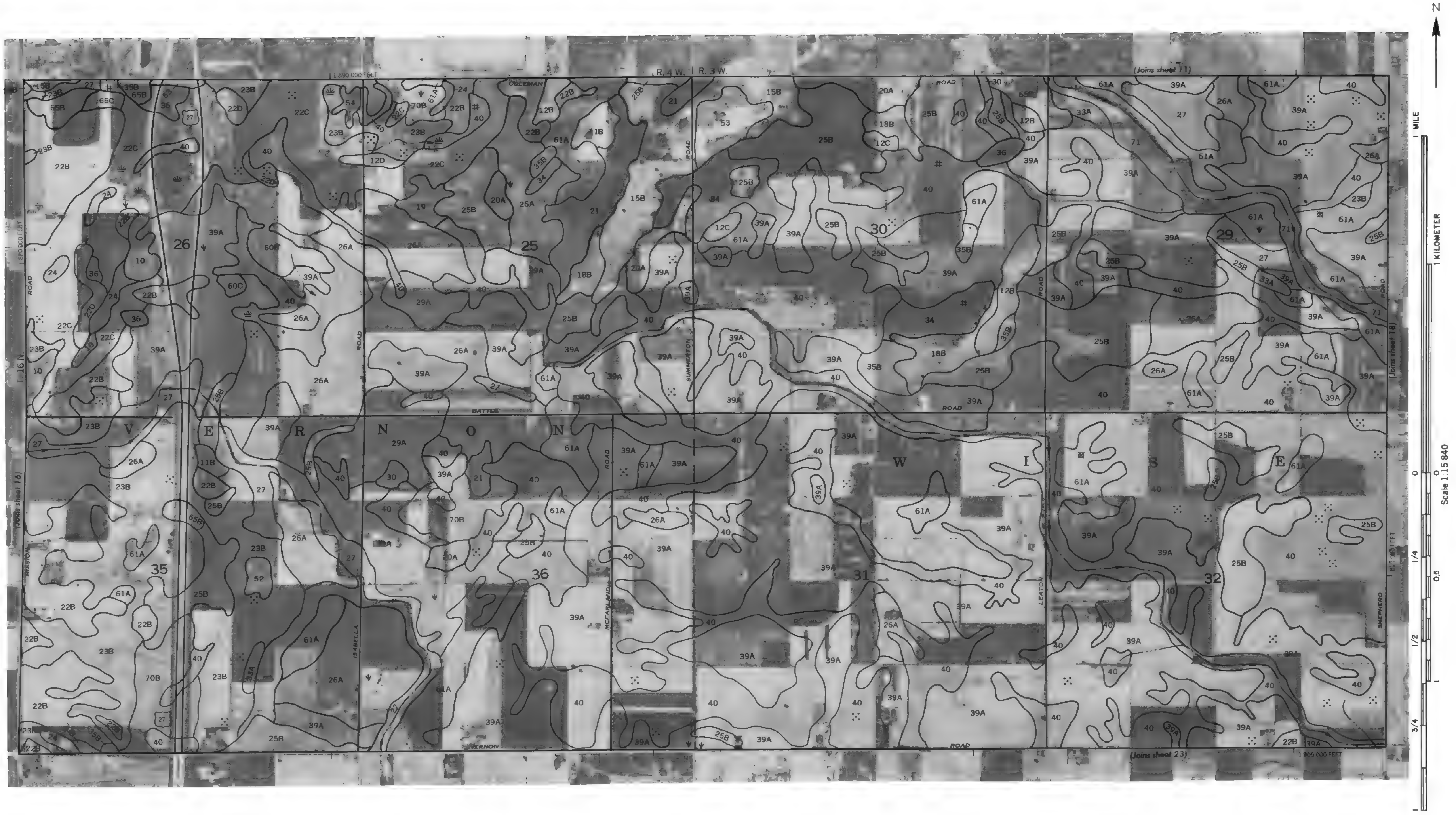

N
(Joins sheet 11)
(Joins sheet 18)
(Joins sheet 23)
(Joins sheet 16)
R. 4 W.
R. 3 W.
T. 16 N.
1 890 000 FEET
1 905 000 FEET
690 000 FEET
COLEMAN ROAD
SUMMERTON ROAD
BATTLE ROAD
ISABELLA ROAD
MCFARLAND ROAD
LEATON ROAD
SHEPHERD ROAD
MISSION ROAD
VERNON ROAD
V E R N O N
W I S E
25
26
29
30
31
32
35
36
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 18

N

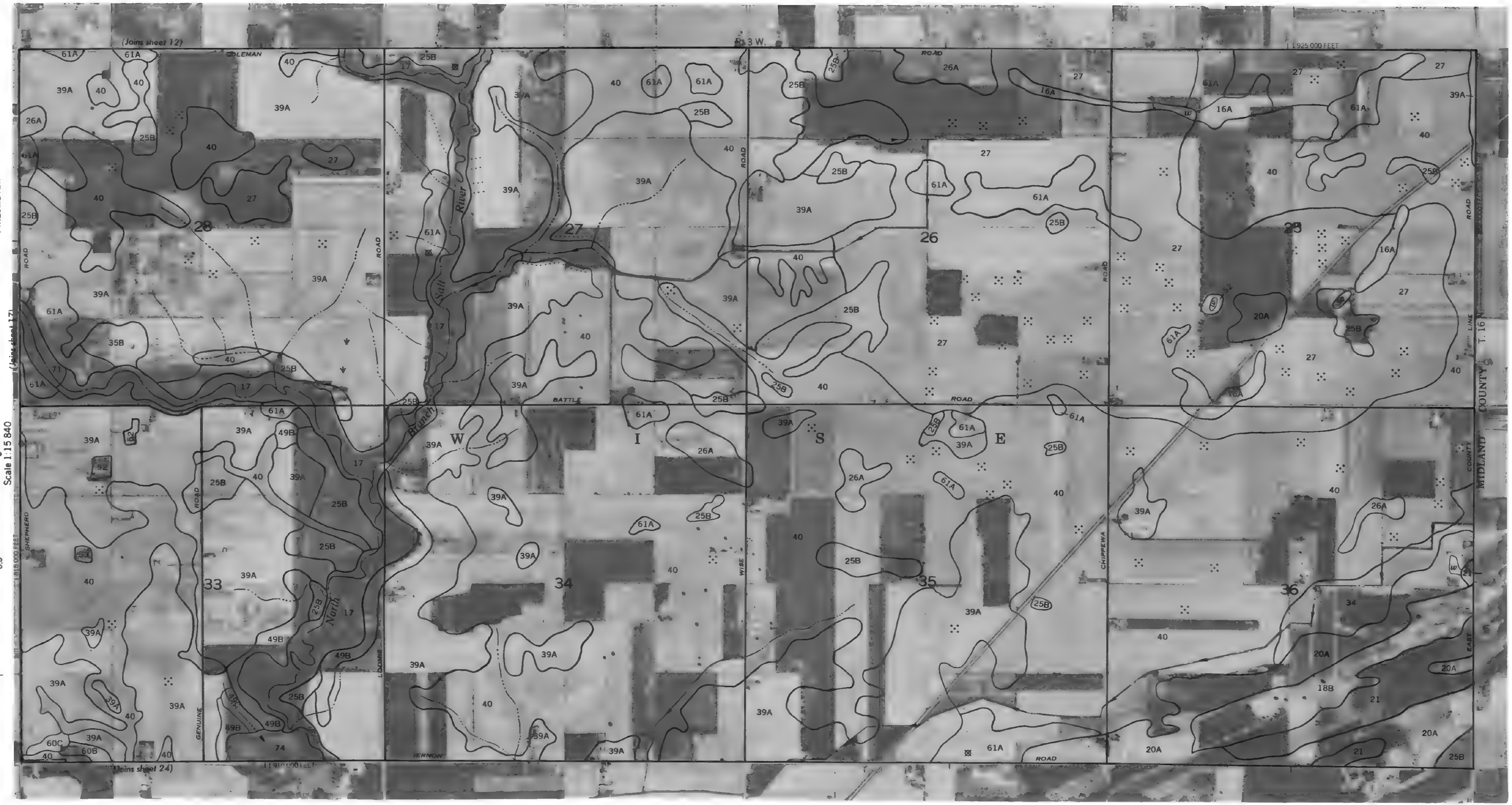
1 MILE

1 KILOMETER

Scale 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1



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SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 19

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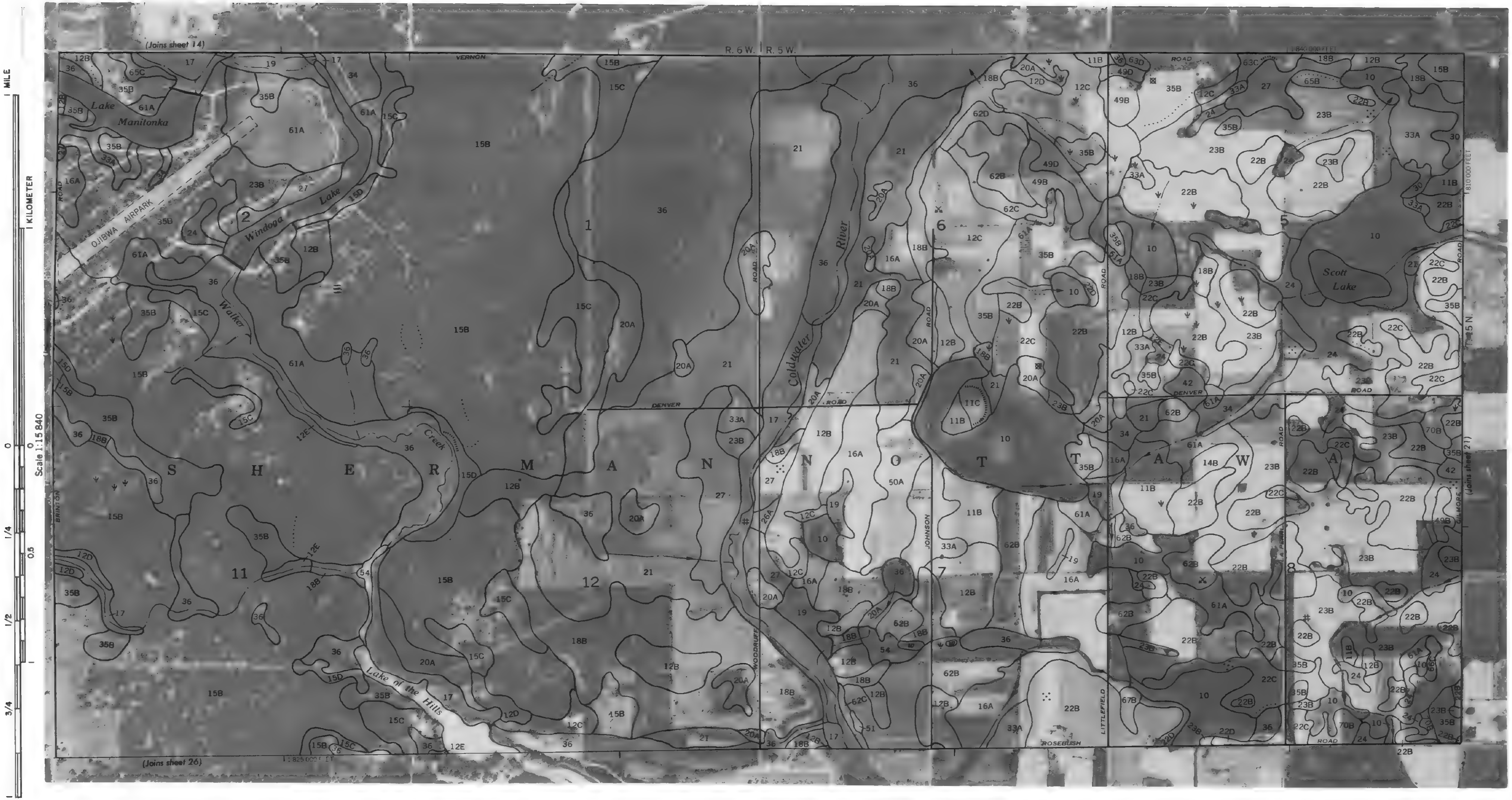

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SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 21

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SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 22

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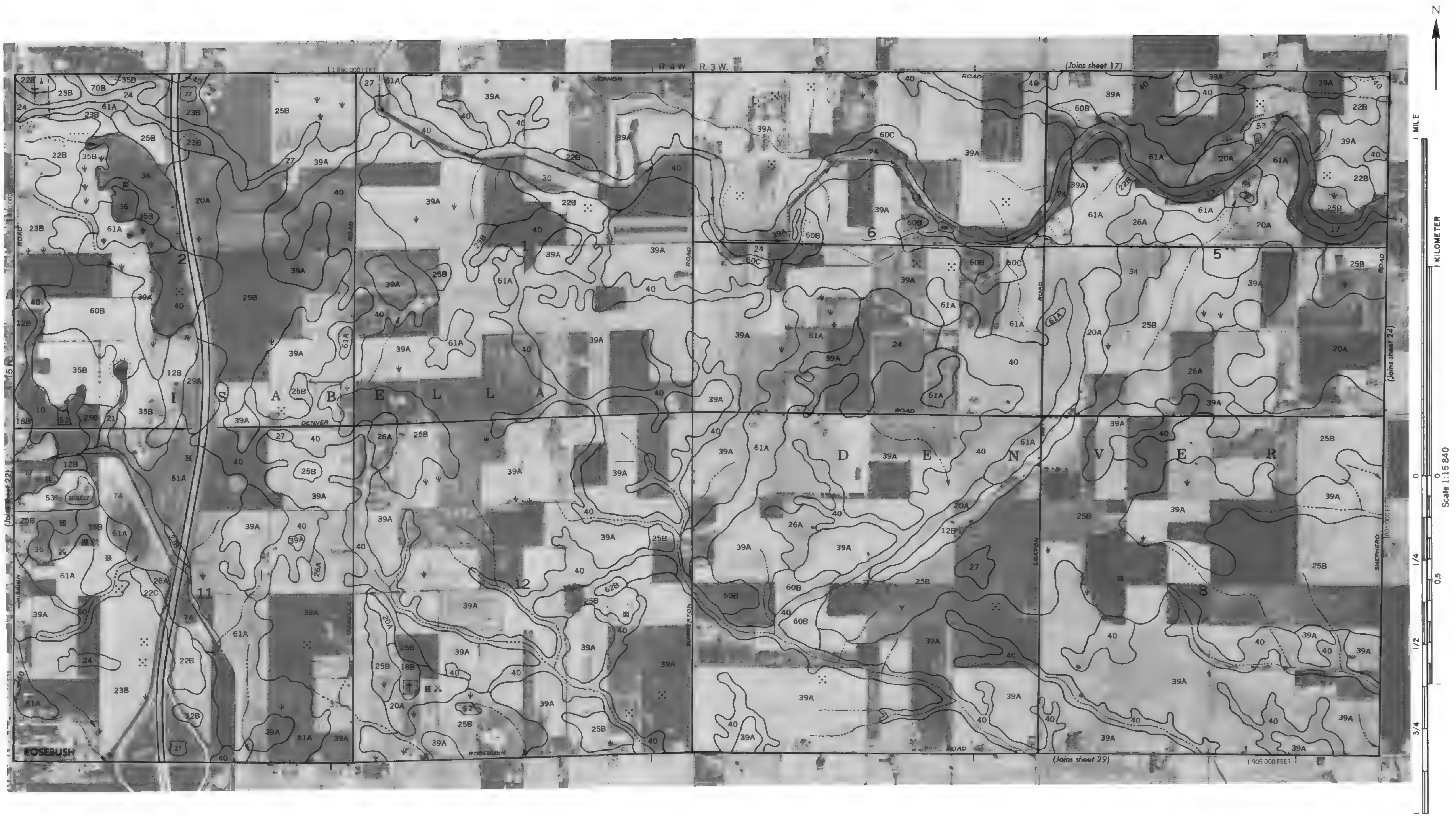

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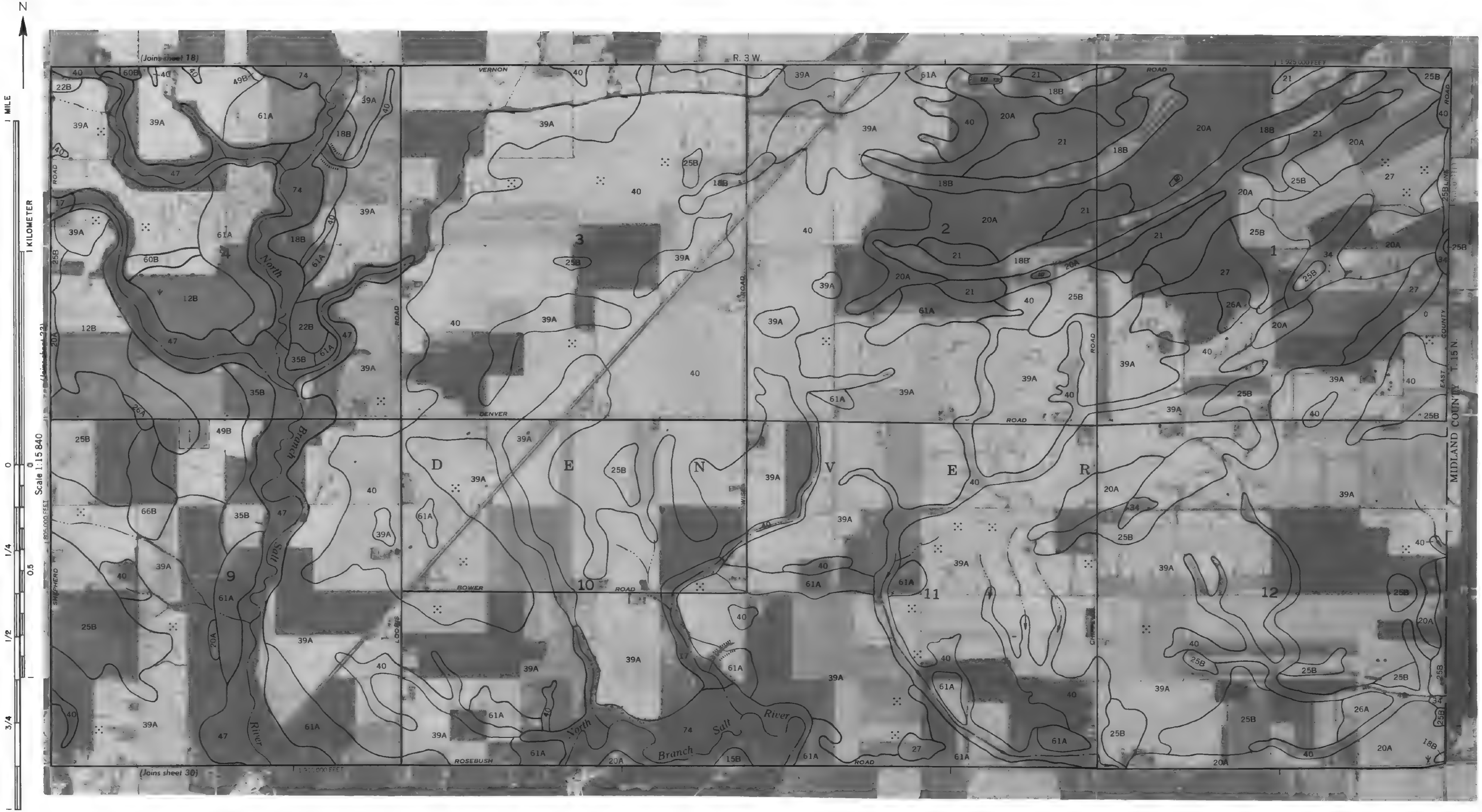
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 24



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26

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 26

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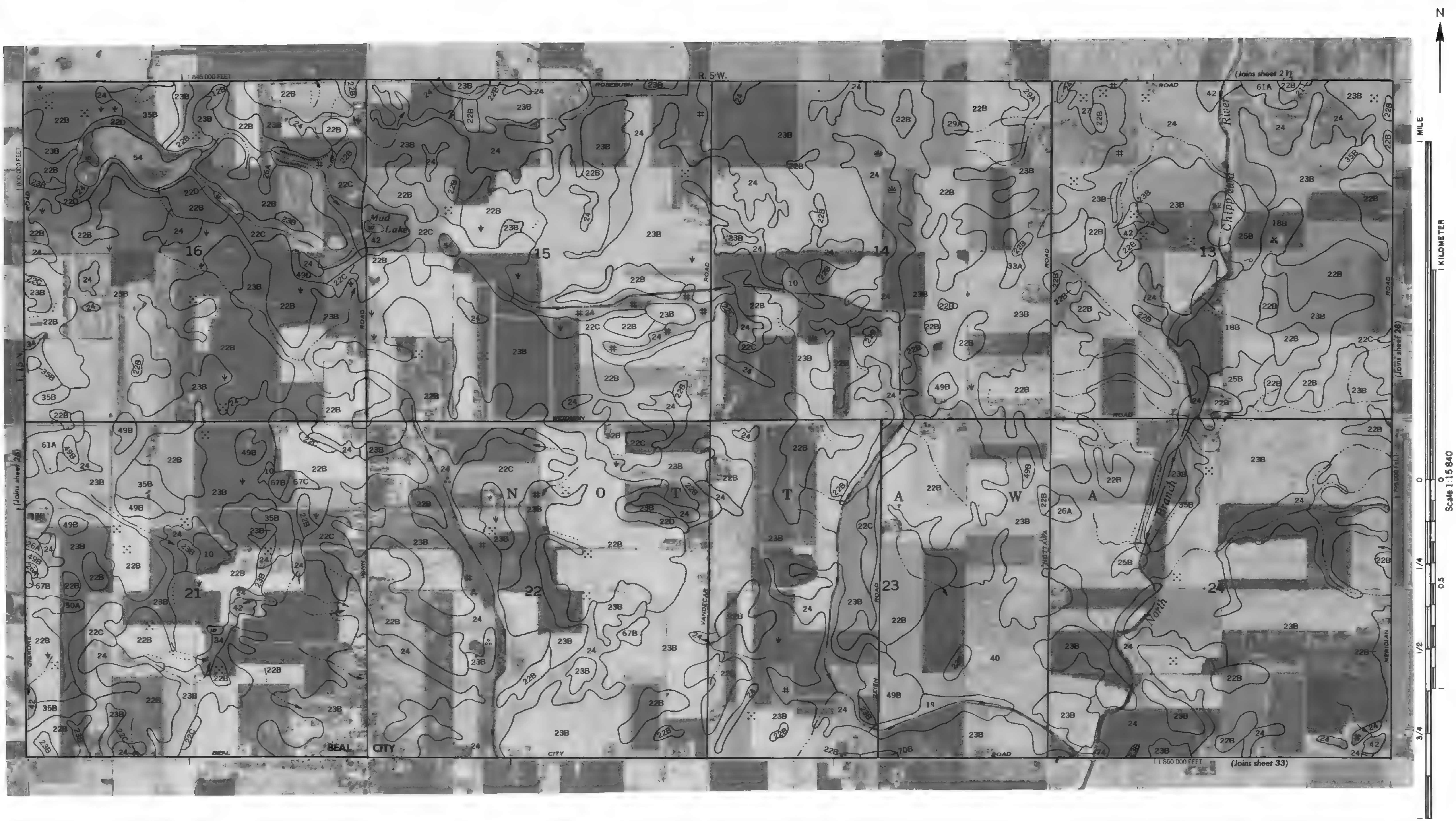
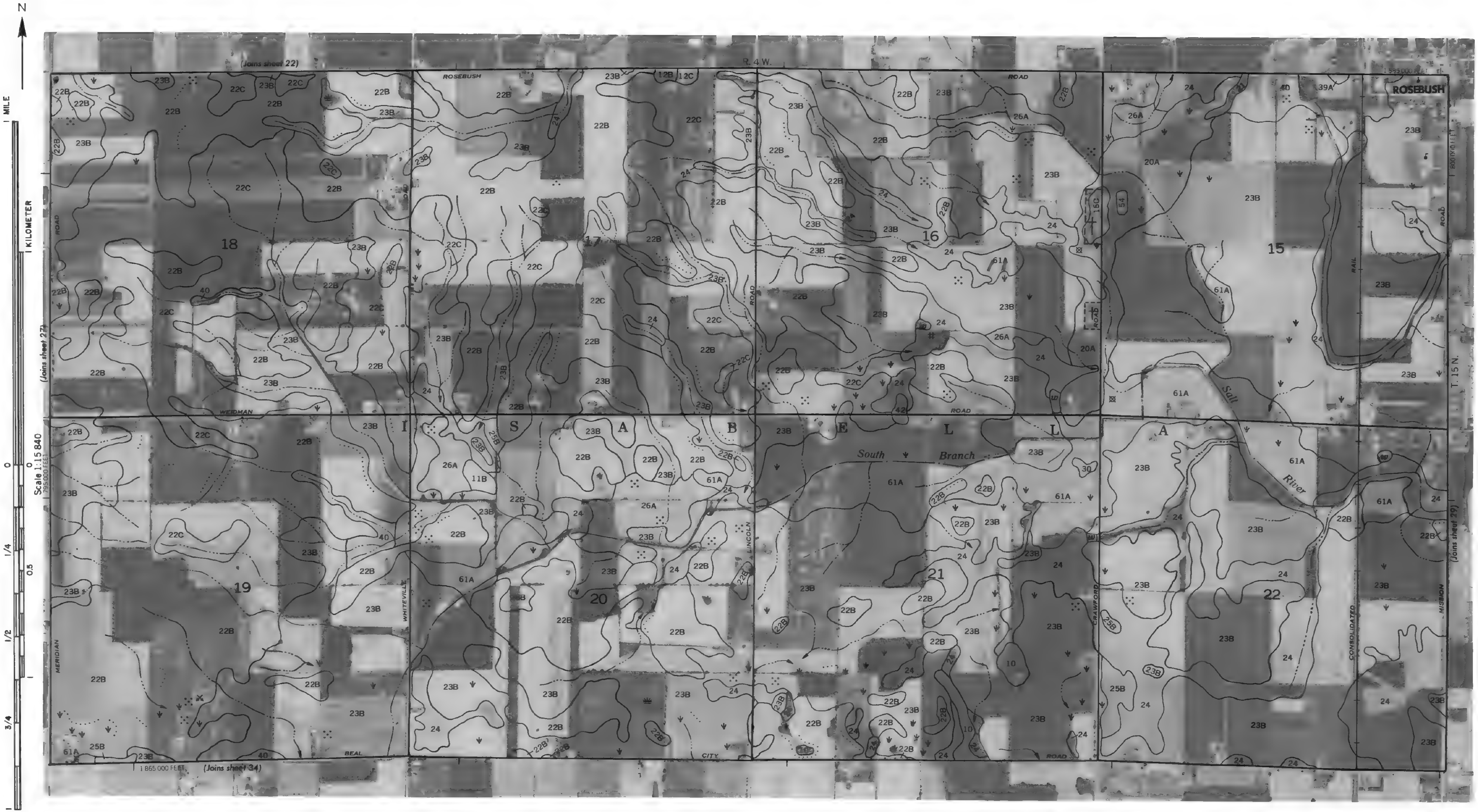
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 27

27



SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 28



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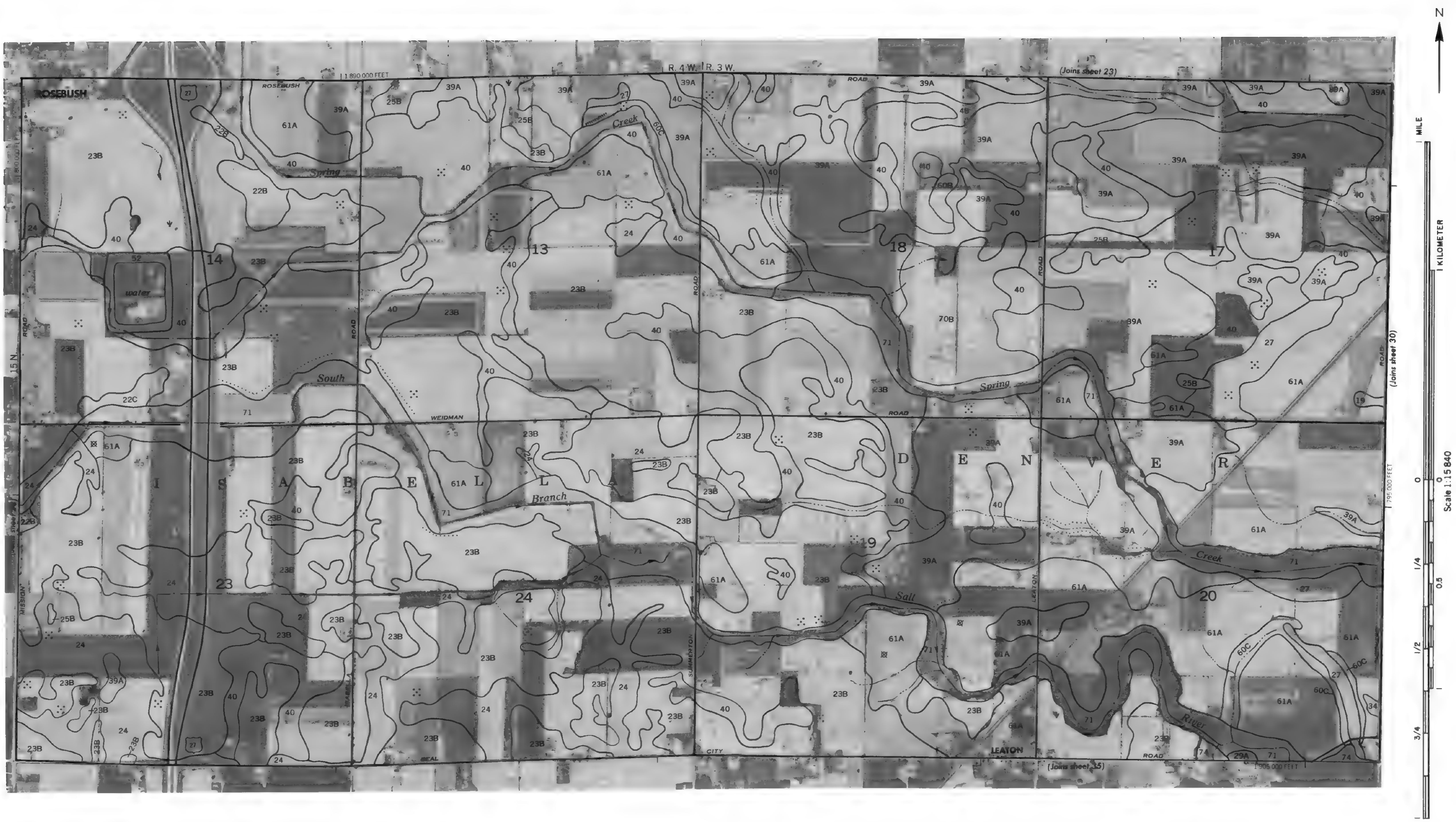
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 29



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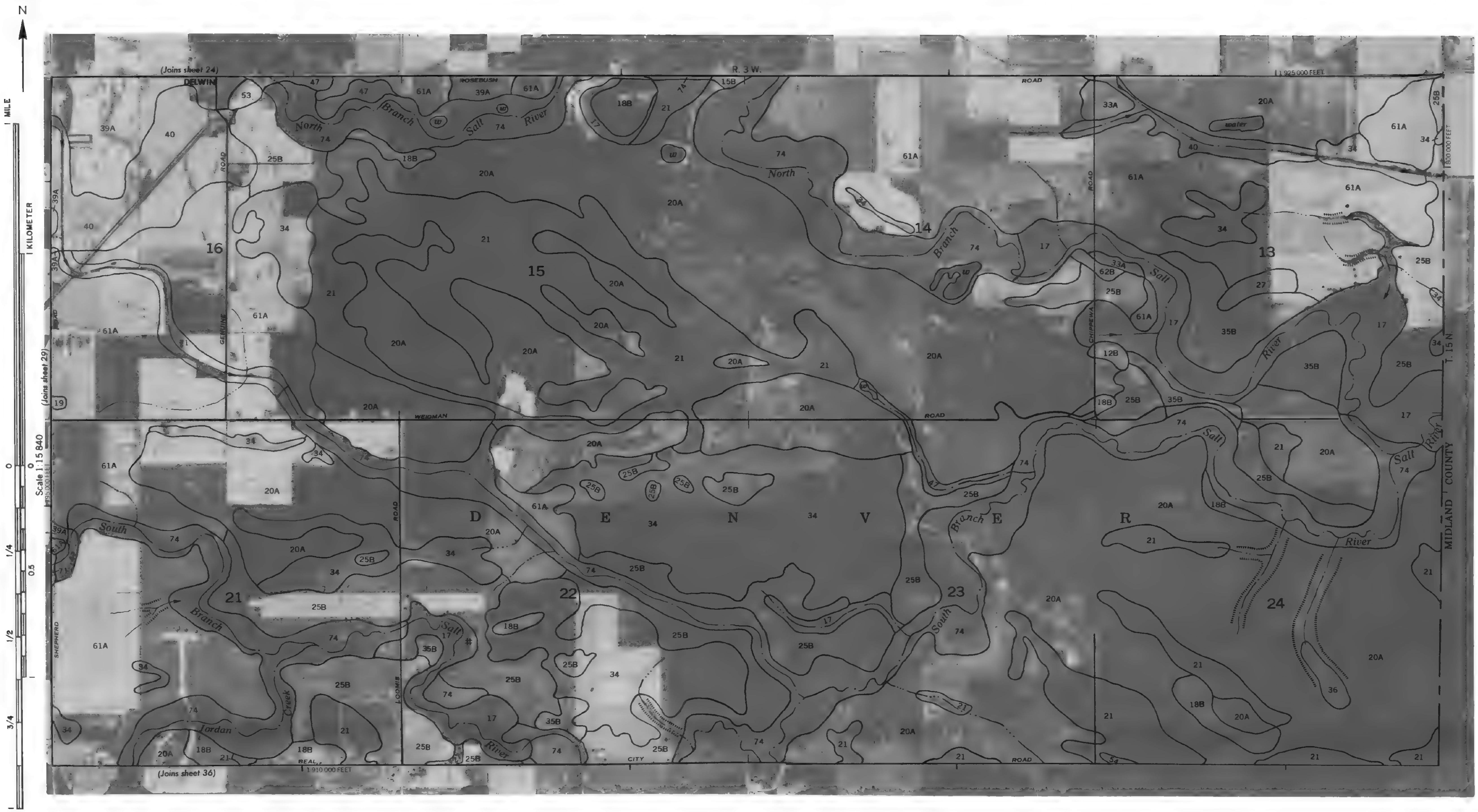
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 30



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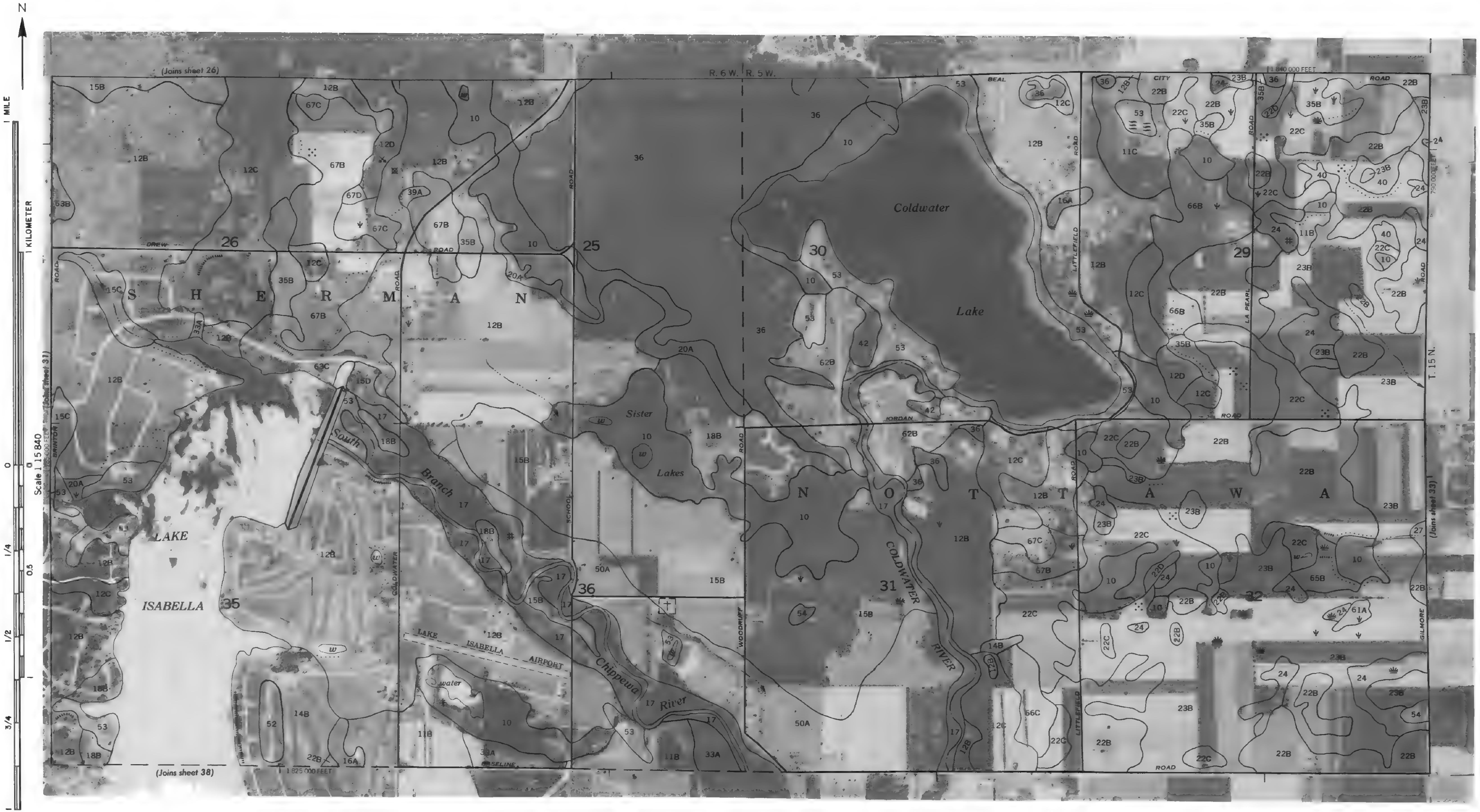
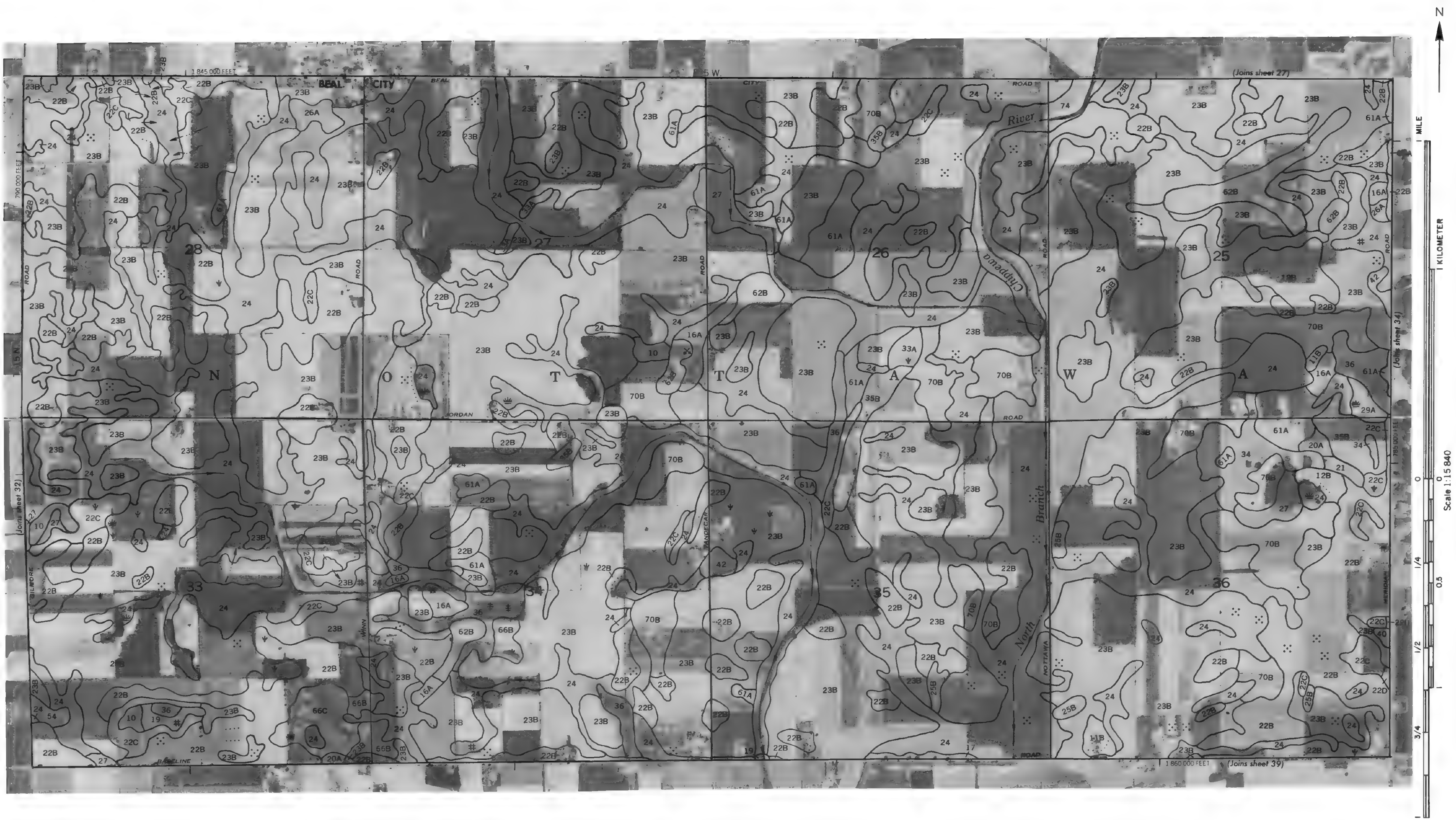
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 32



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 33



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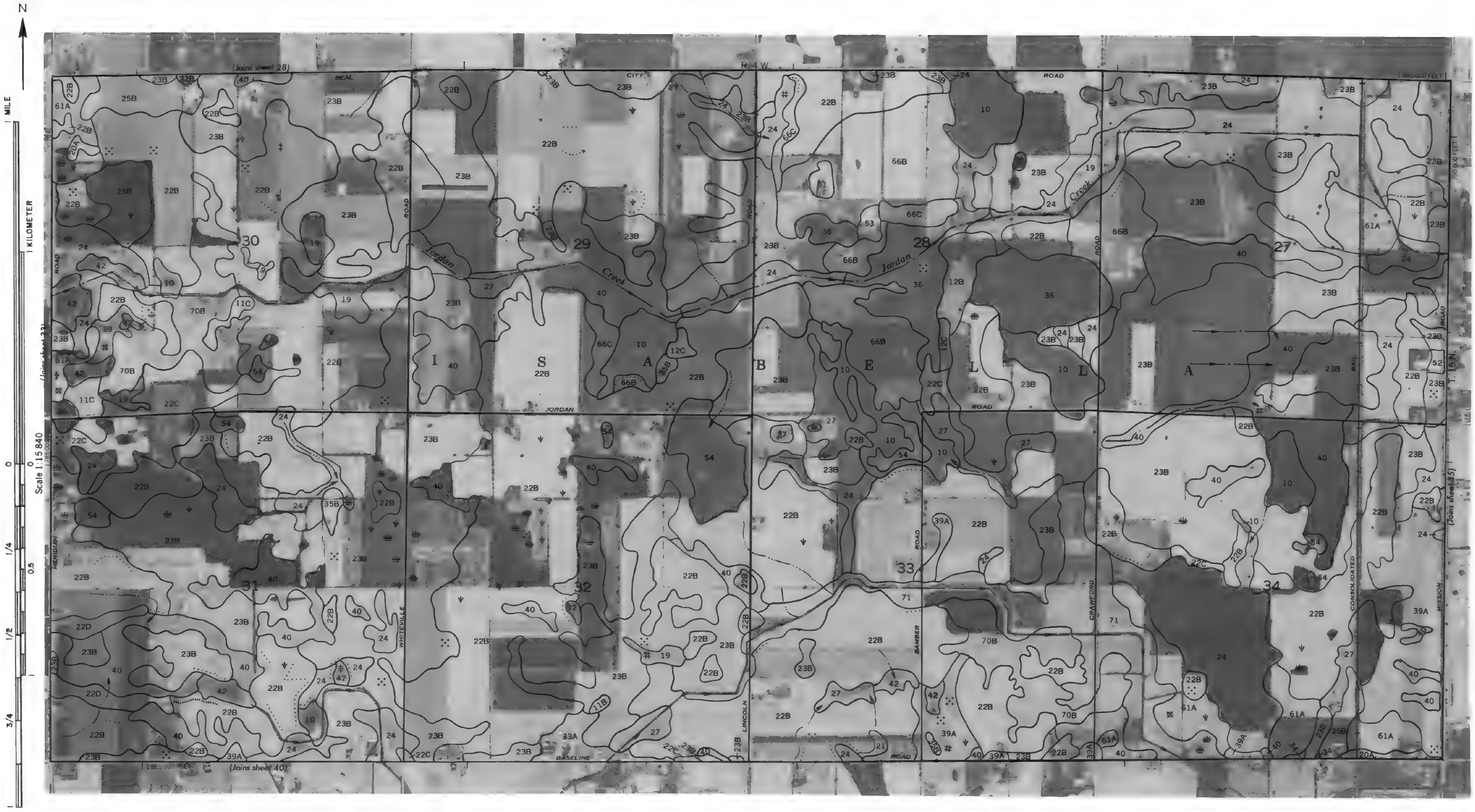
(34)

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 34



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SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 35

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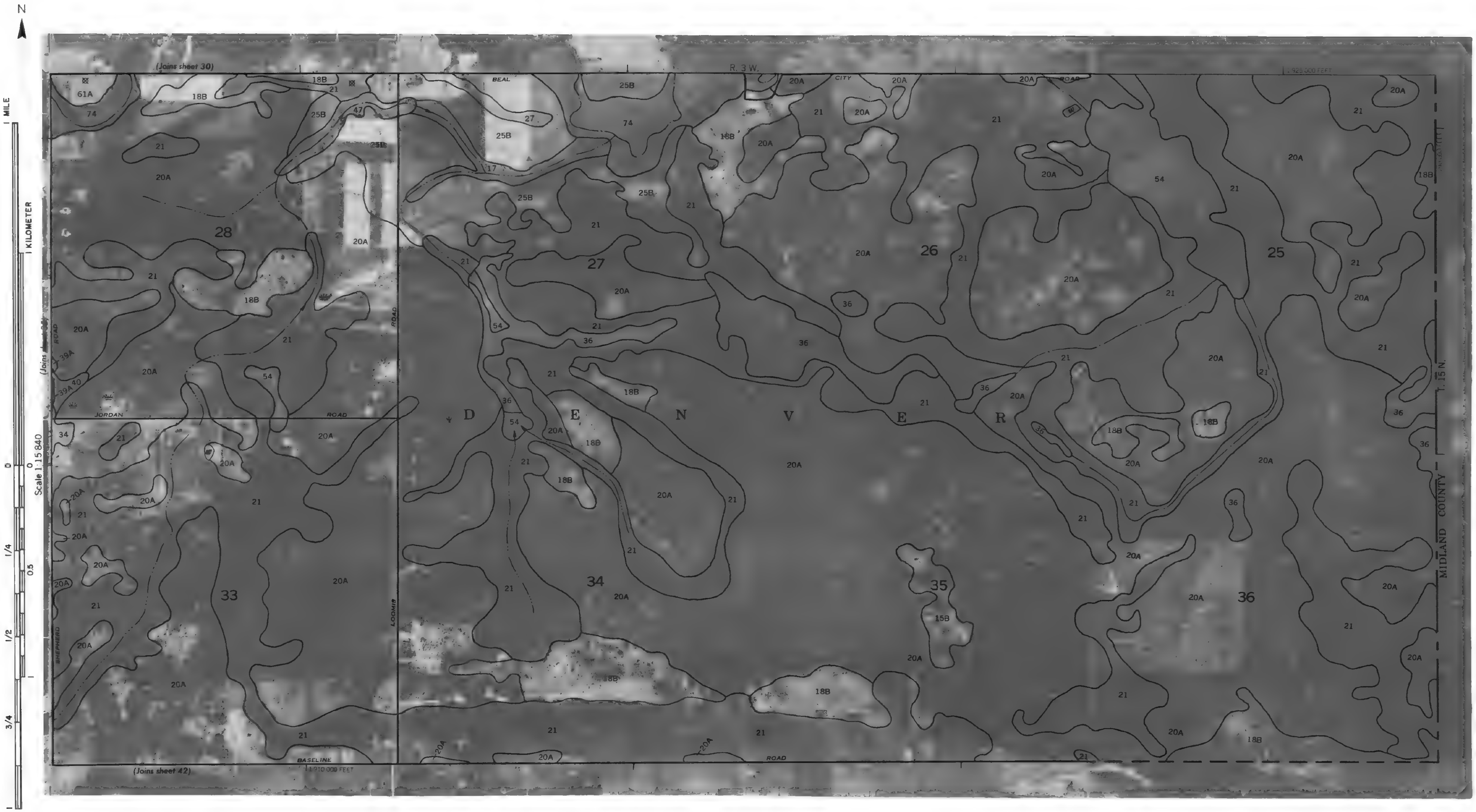
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 36



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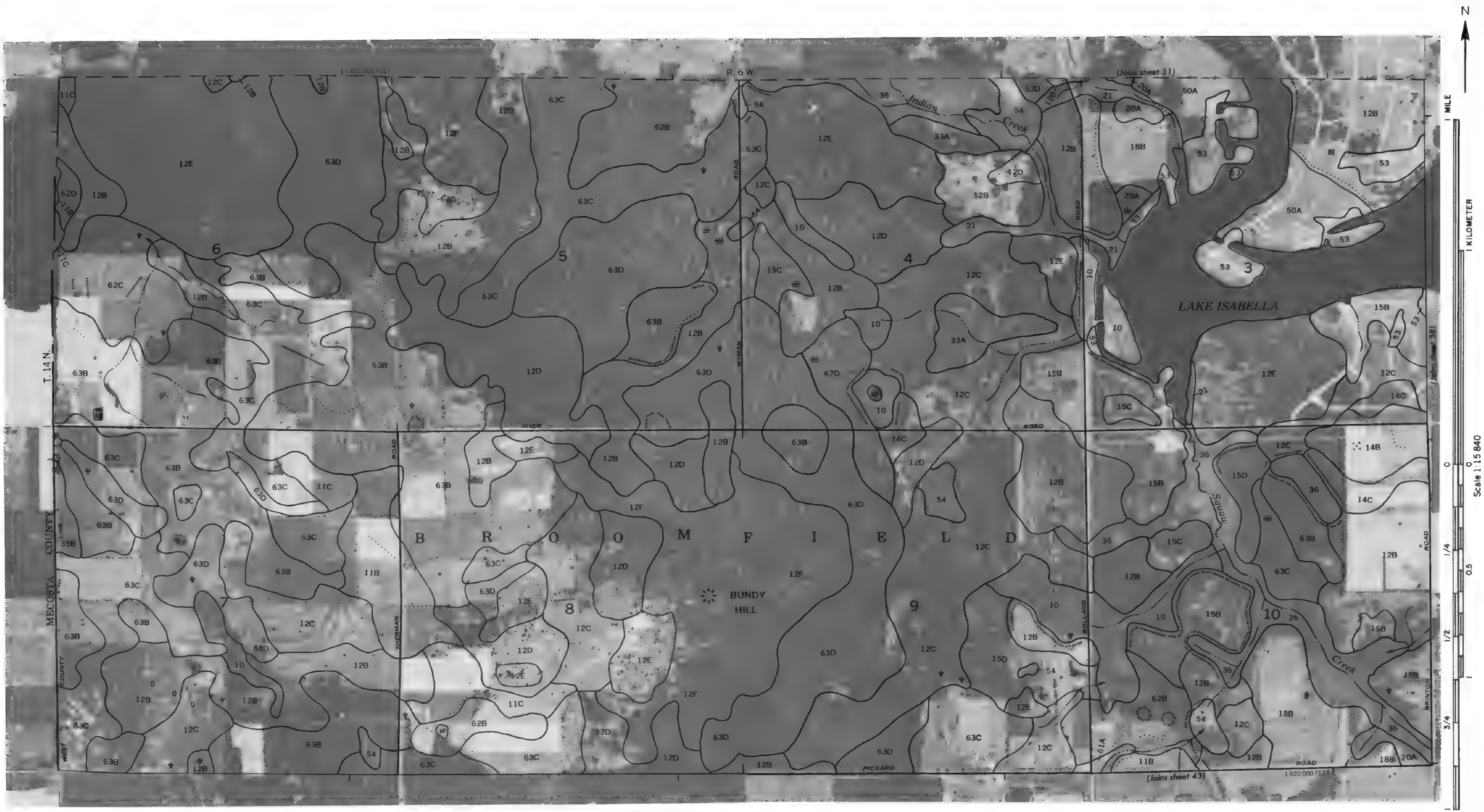

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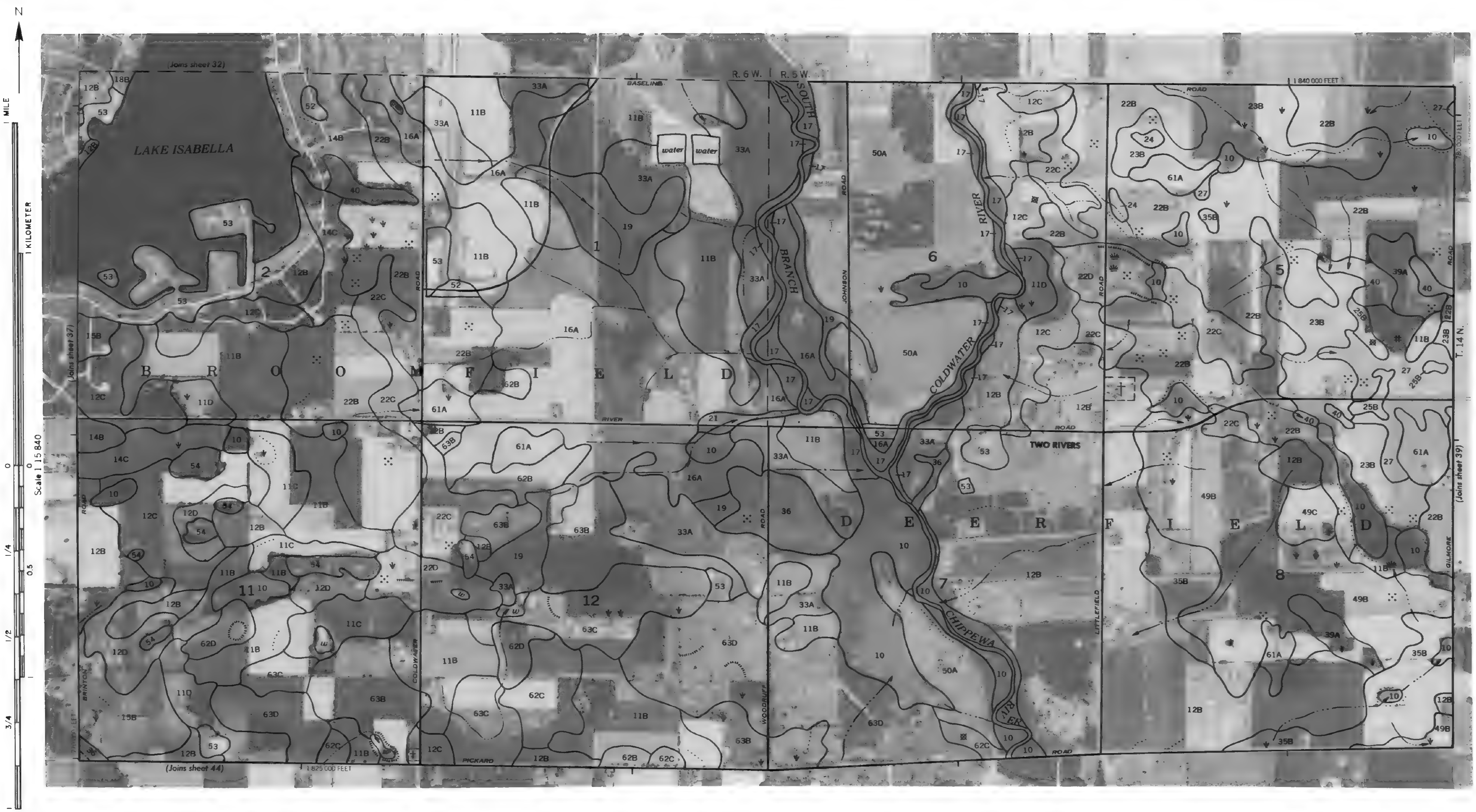
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 38



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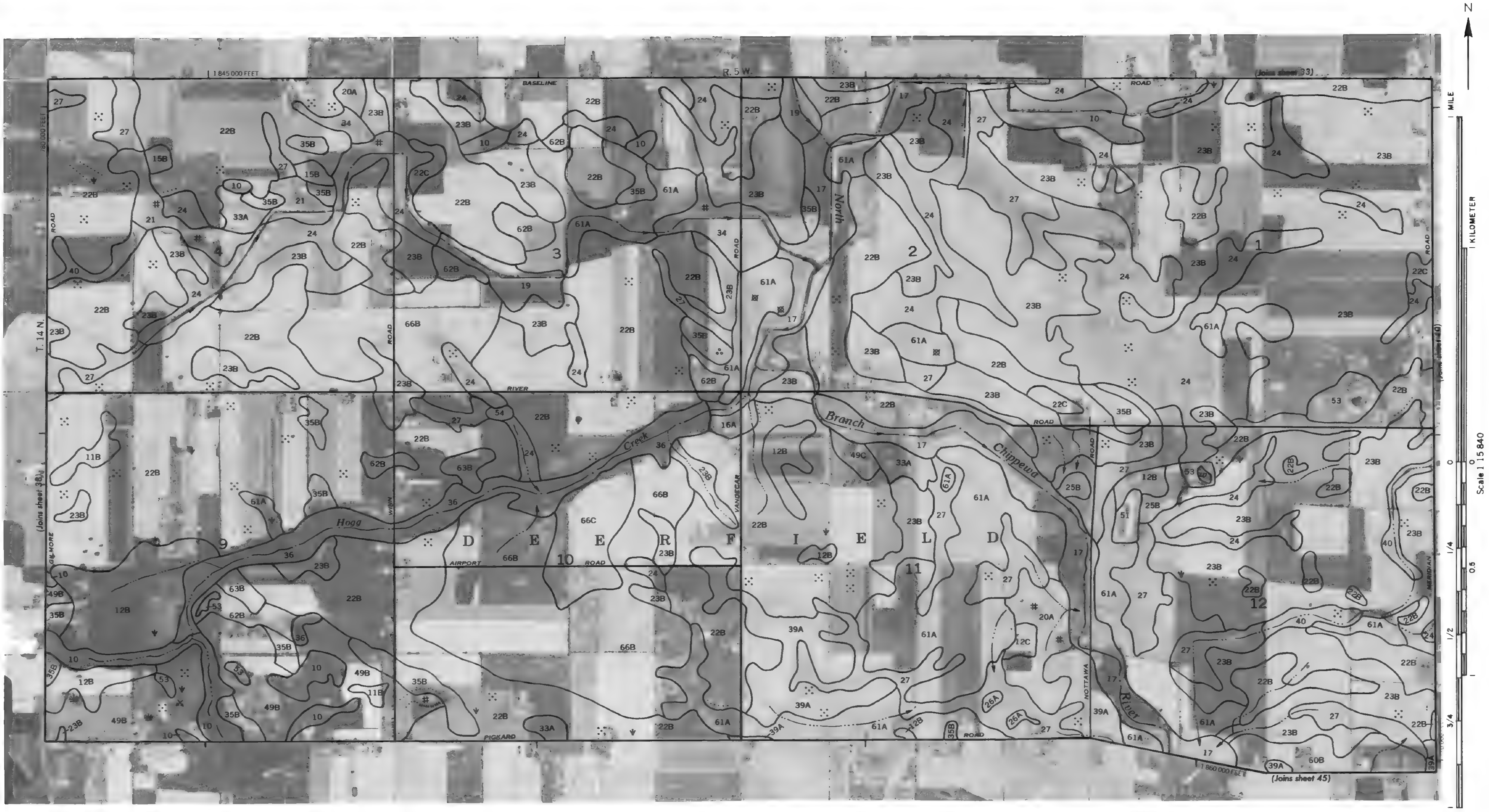

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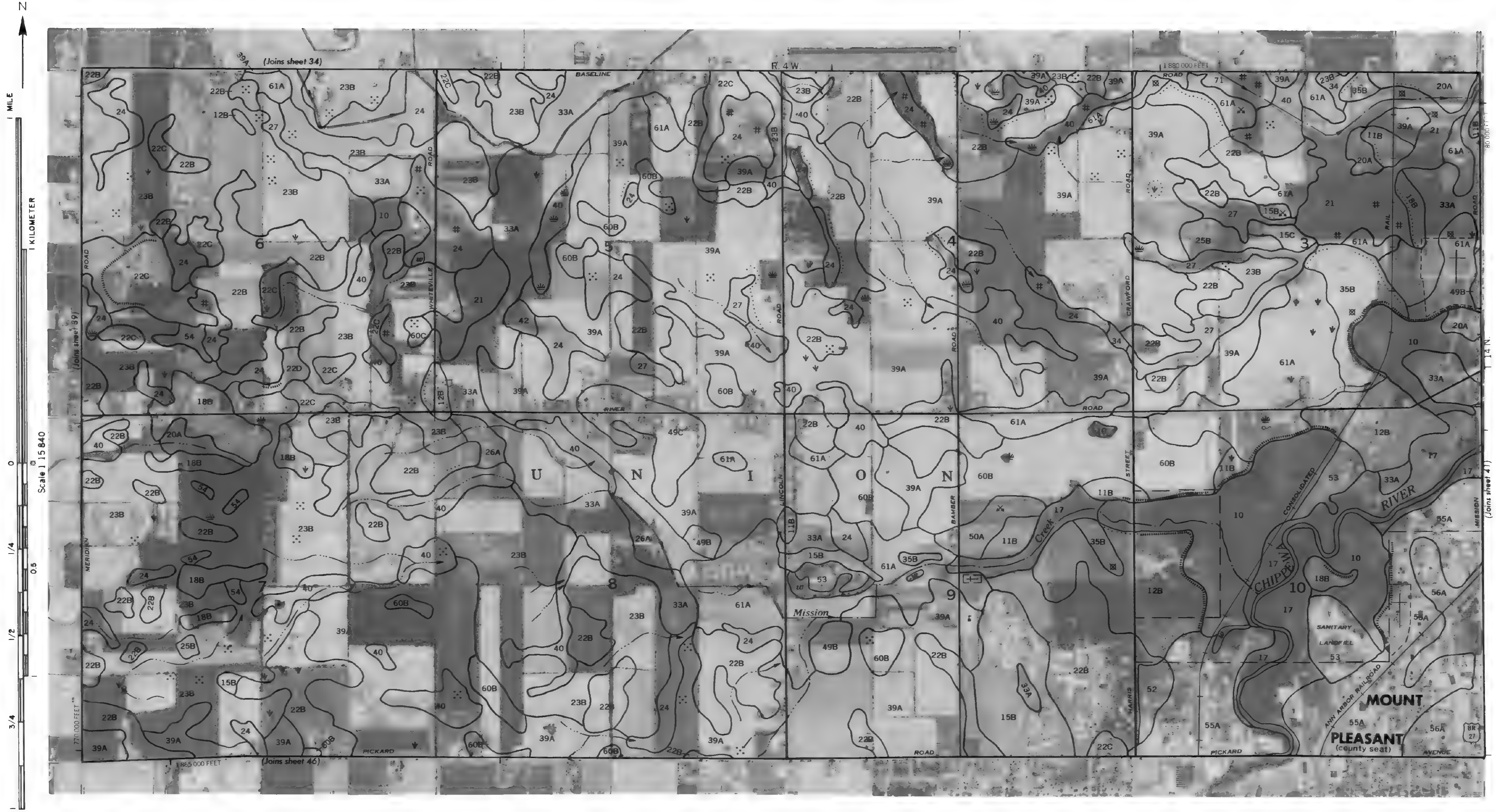
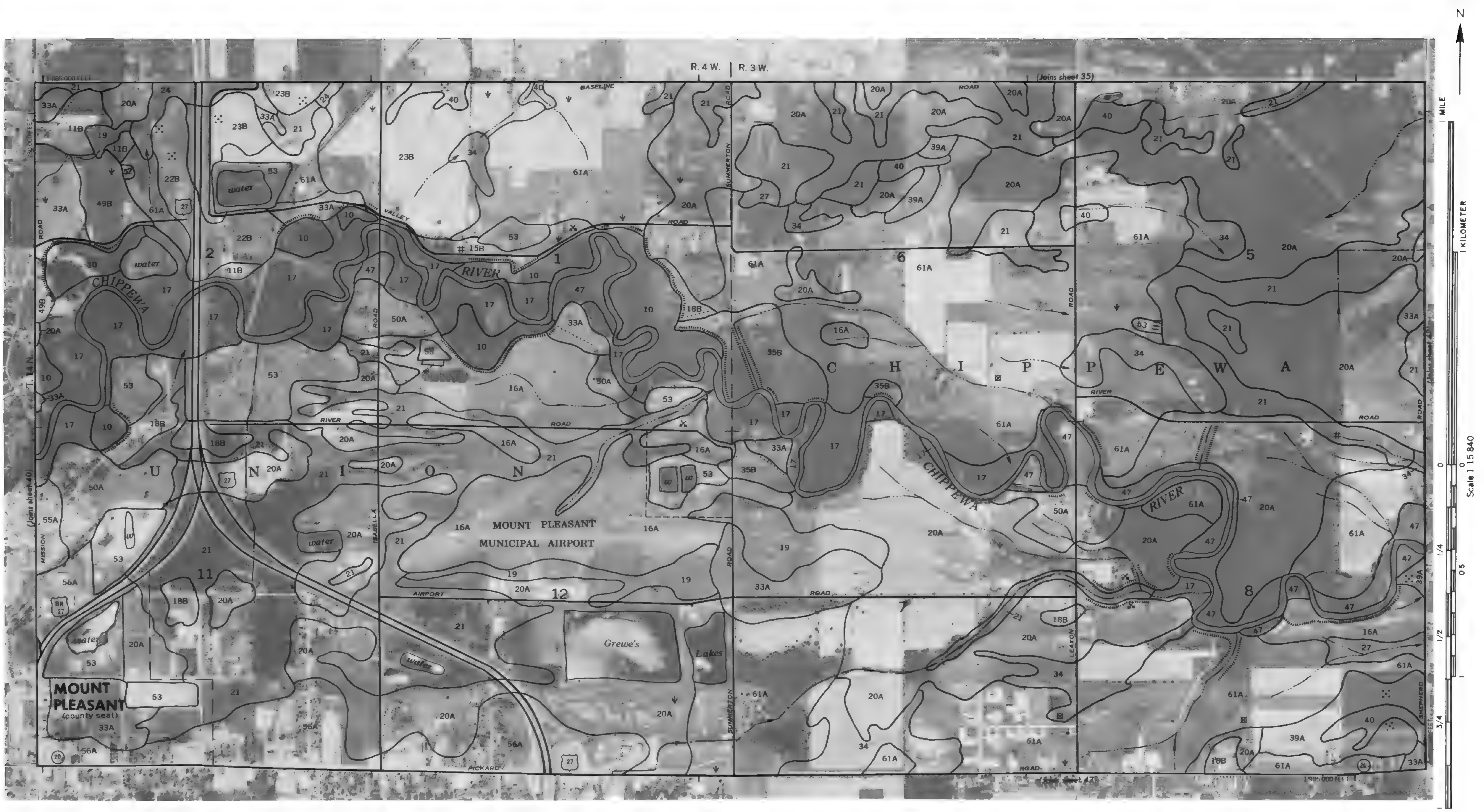
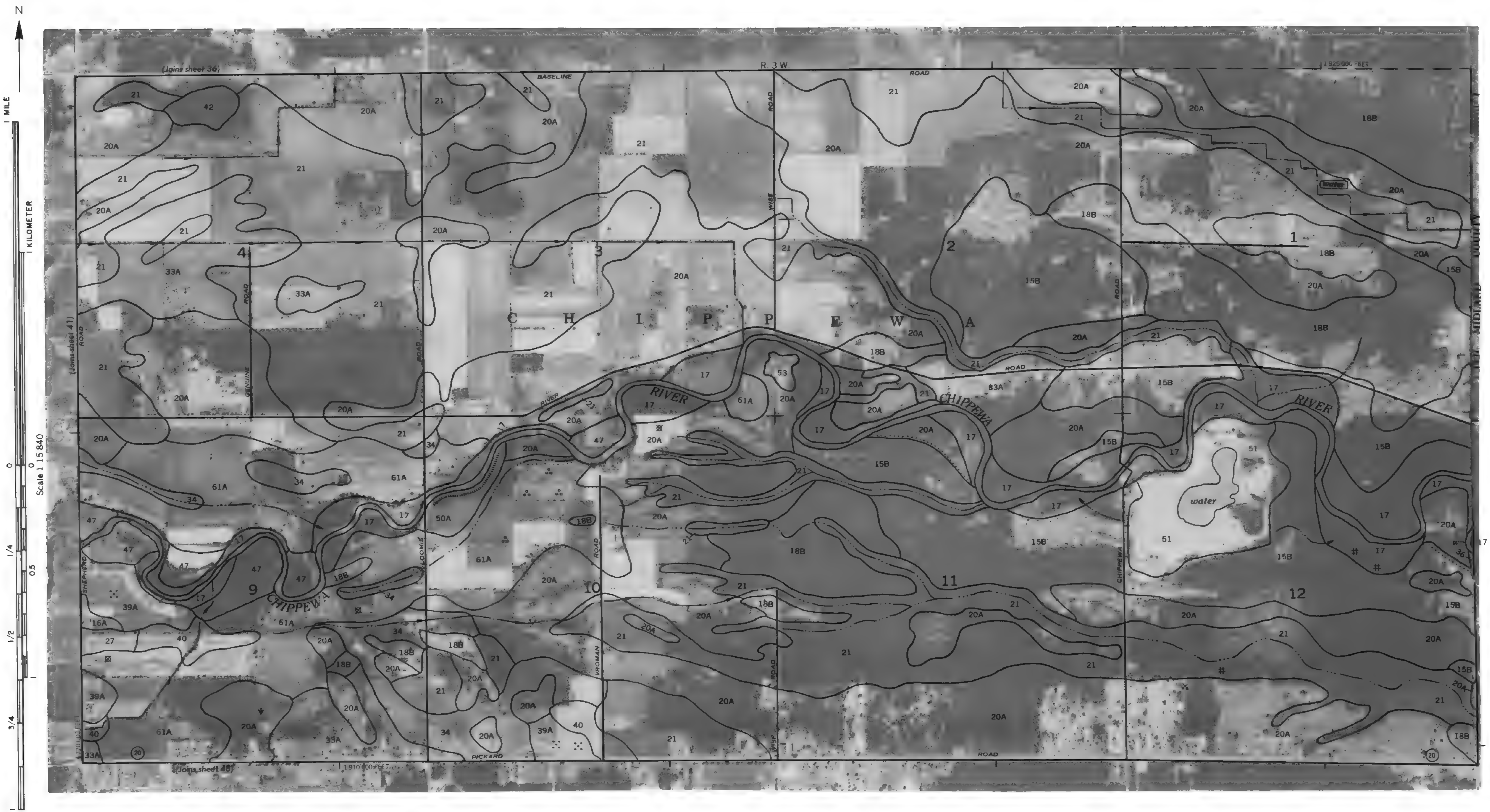
SOIL MA OF ISABELLA COUNTY, MICHIGAN — SHEET NUM ER 40




R. 4 W.
R. 3 W.
(Joins sheet 35)
(Joins sheet 40)
(Joins sheet 47)
T. 14 N.
BASELINE
ROAD
VALLEY
ROAD
SUMMERTON ROAD
ISABELLA ROAD
MISSION ROAD
LEATON ROAD
SHEPHERD ROAD
RIVER ROAD
AIRPORT ROAD
PICKARD ROAD
CHIPPEWA RIVER
C H I P P E W A
U N I O N
MOUNT PLEASANT MUNICIPAL AIRPORT
Grewe's Lakes
water
MOUNT PLEASANT
(county seat)
1
2
5
6
7
8
11
12
N
1 MILE
1 KILOMETER
Scale 1:15 840

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 42



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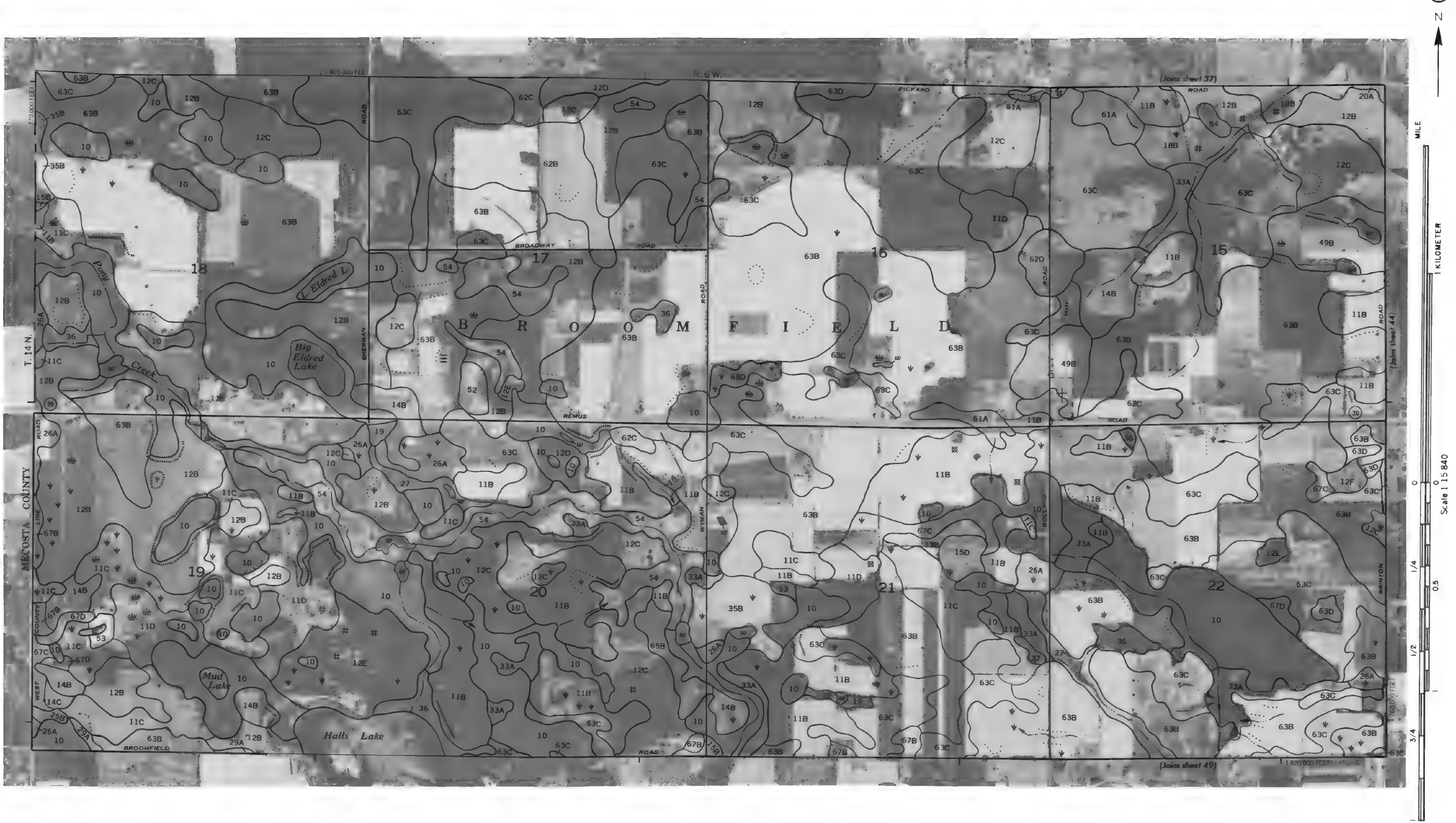
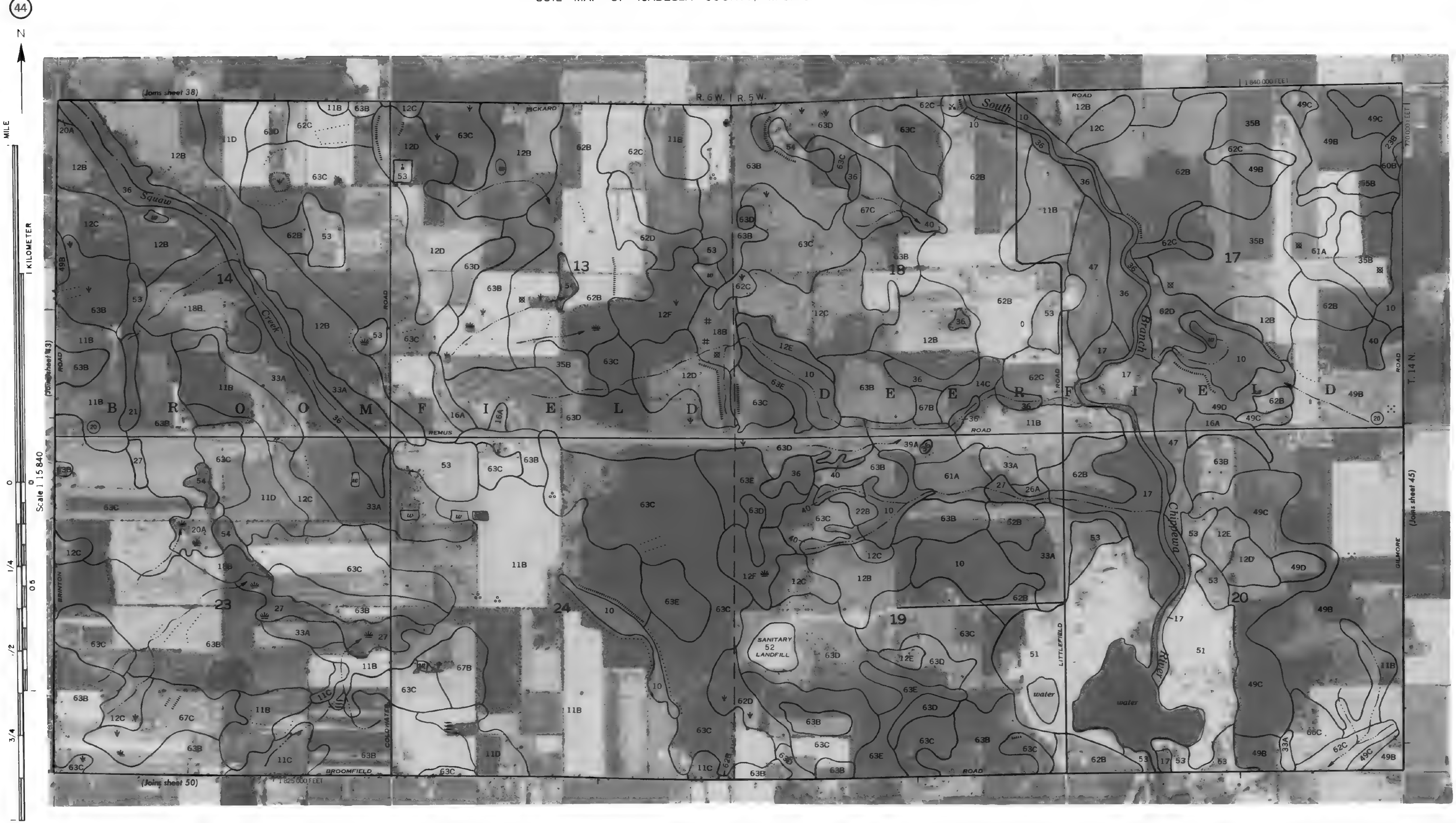
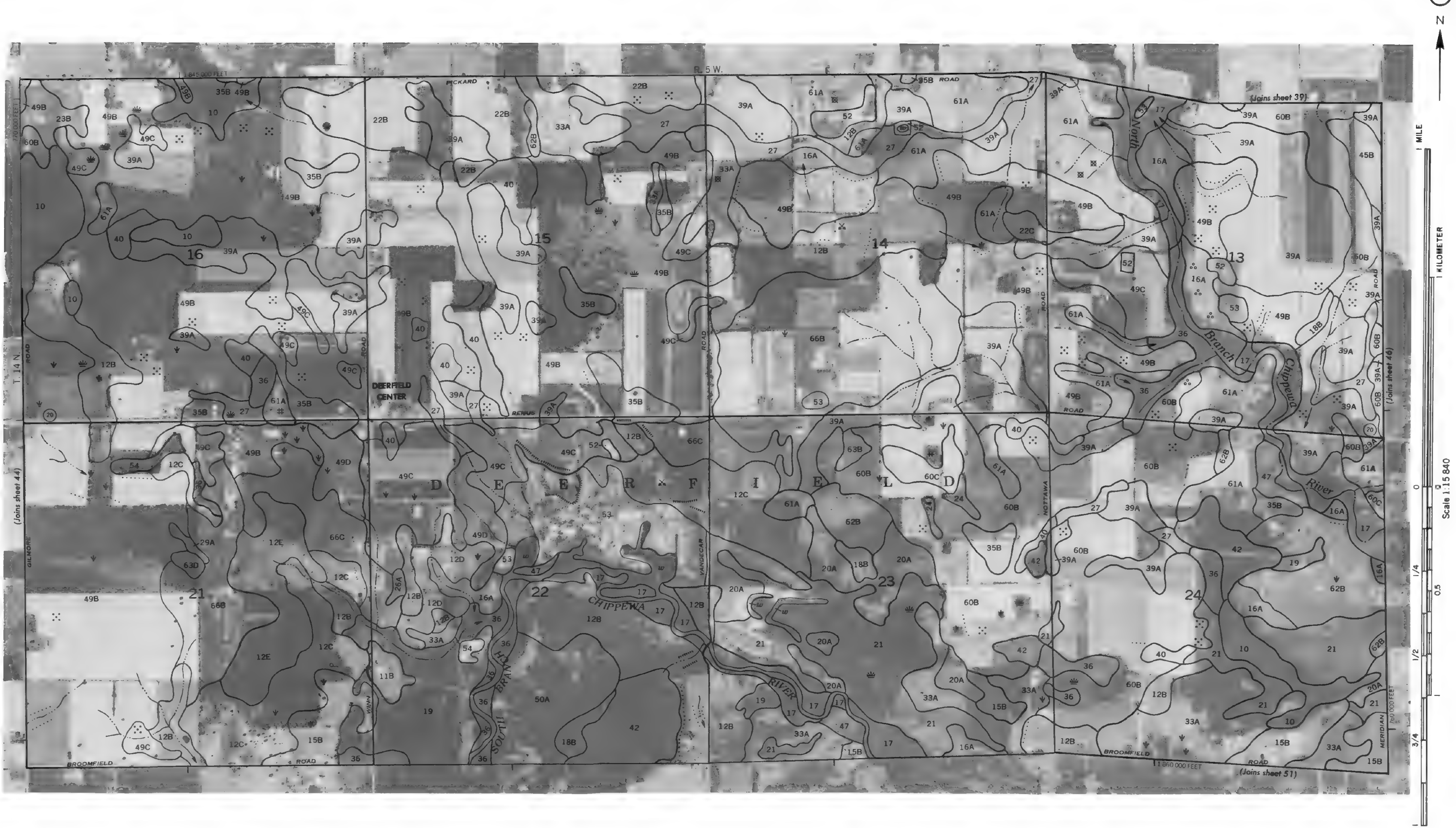
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 43



SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 44





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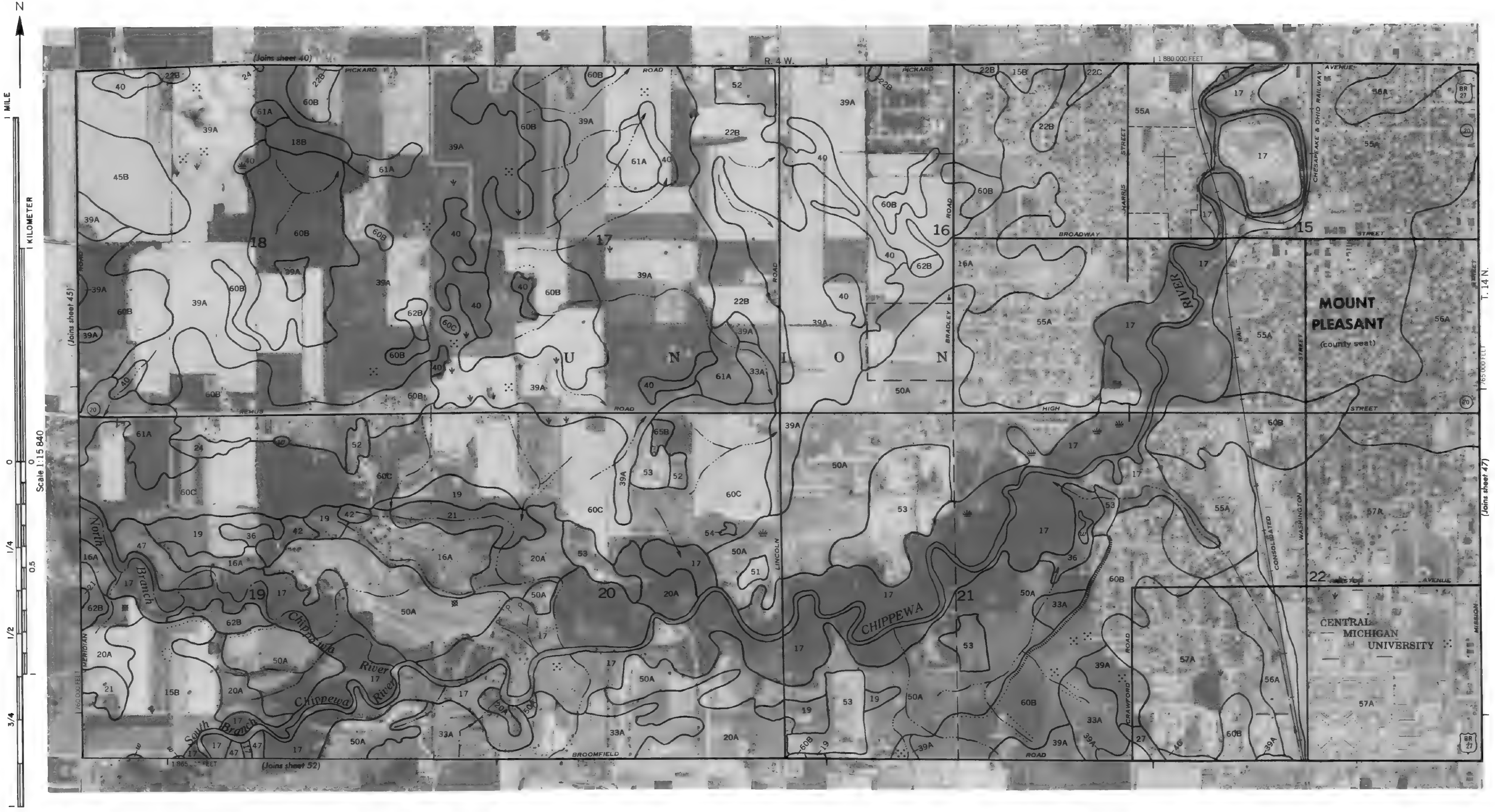
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 46



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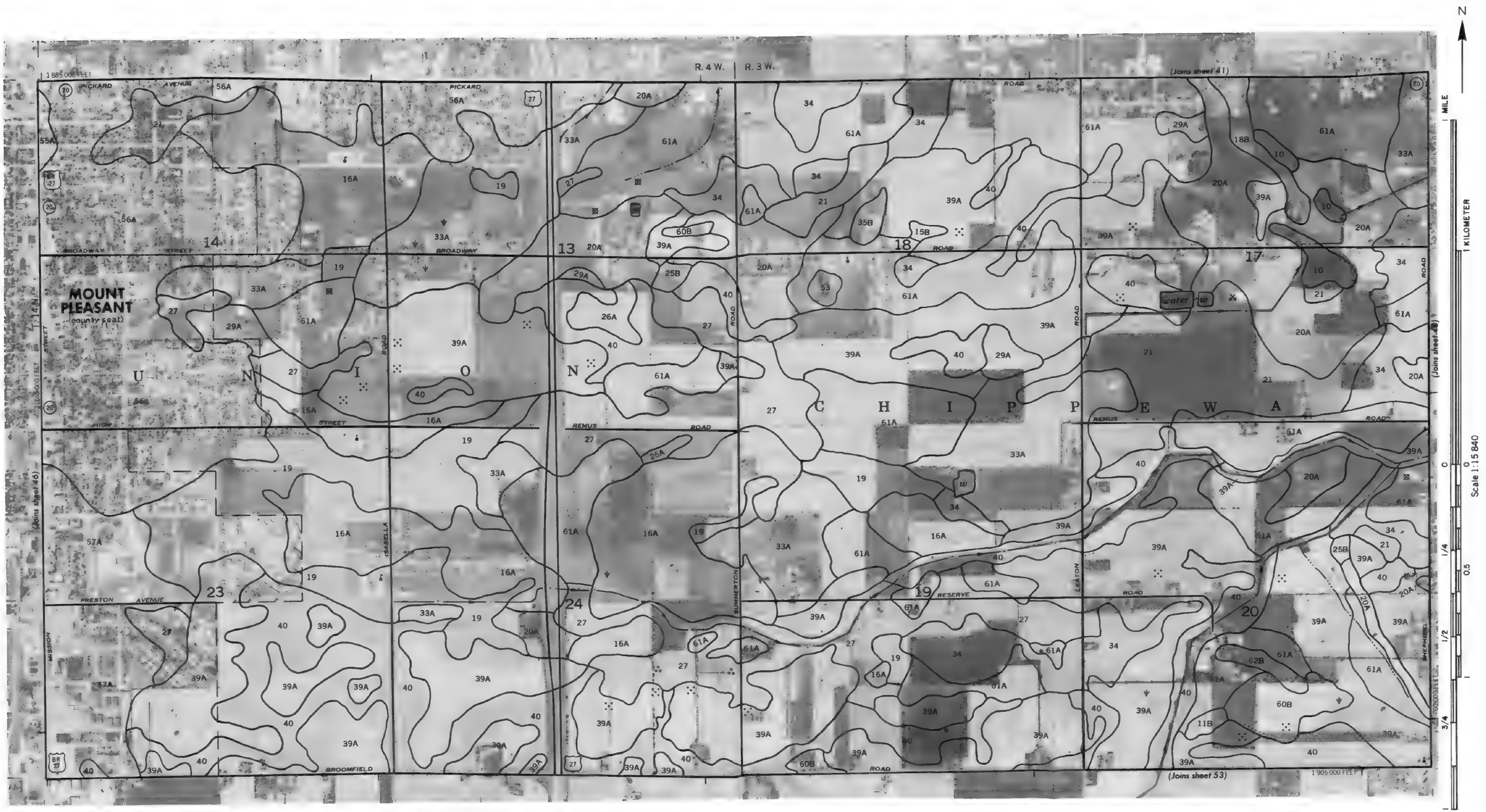

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 48

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

1 MILE

1 KILOMETER

Scale 1:15 840

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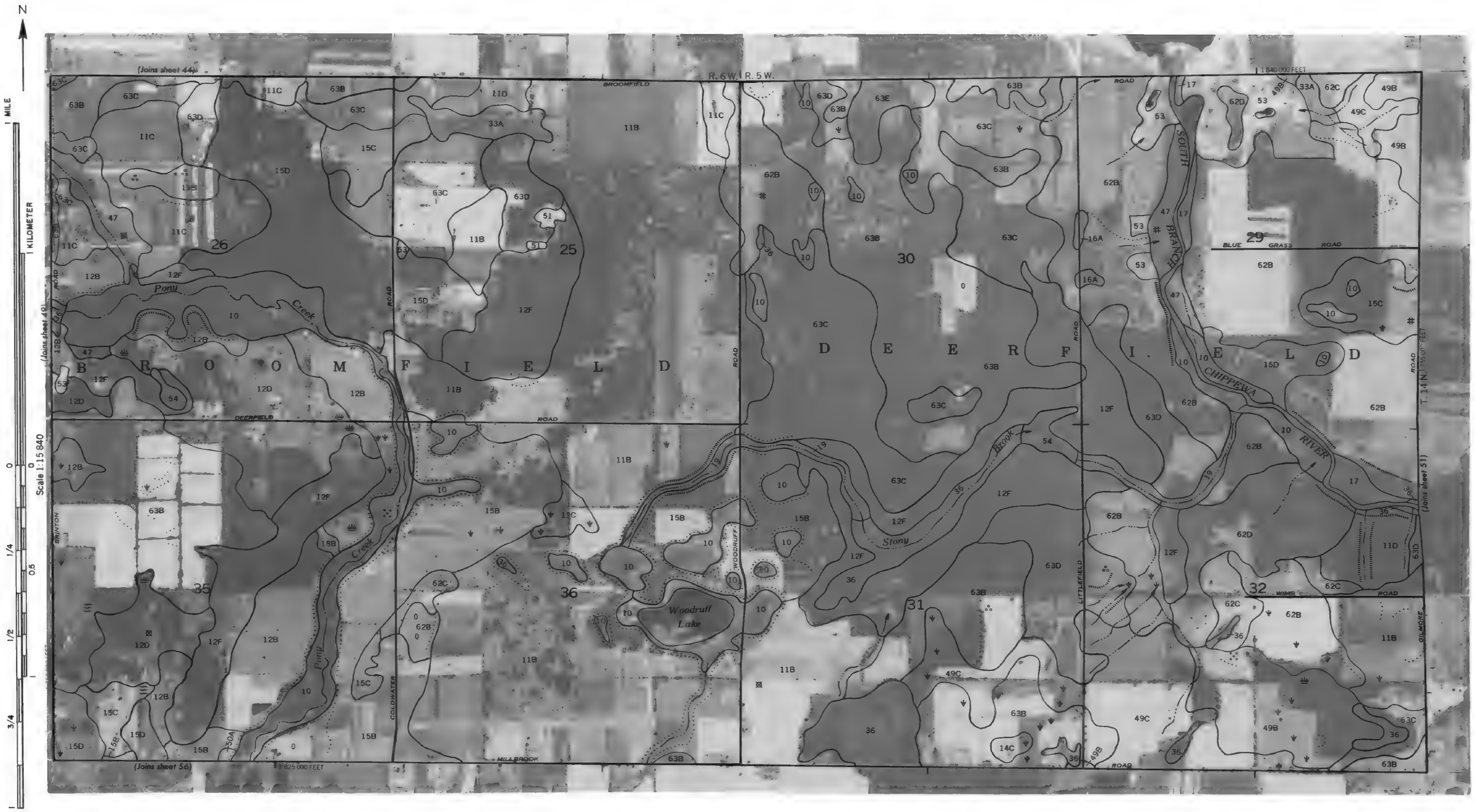
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 50

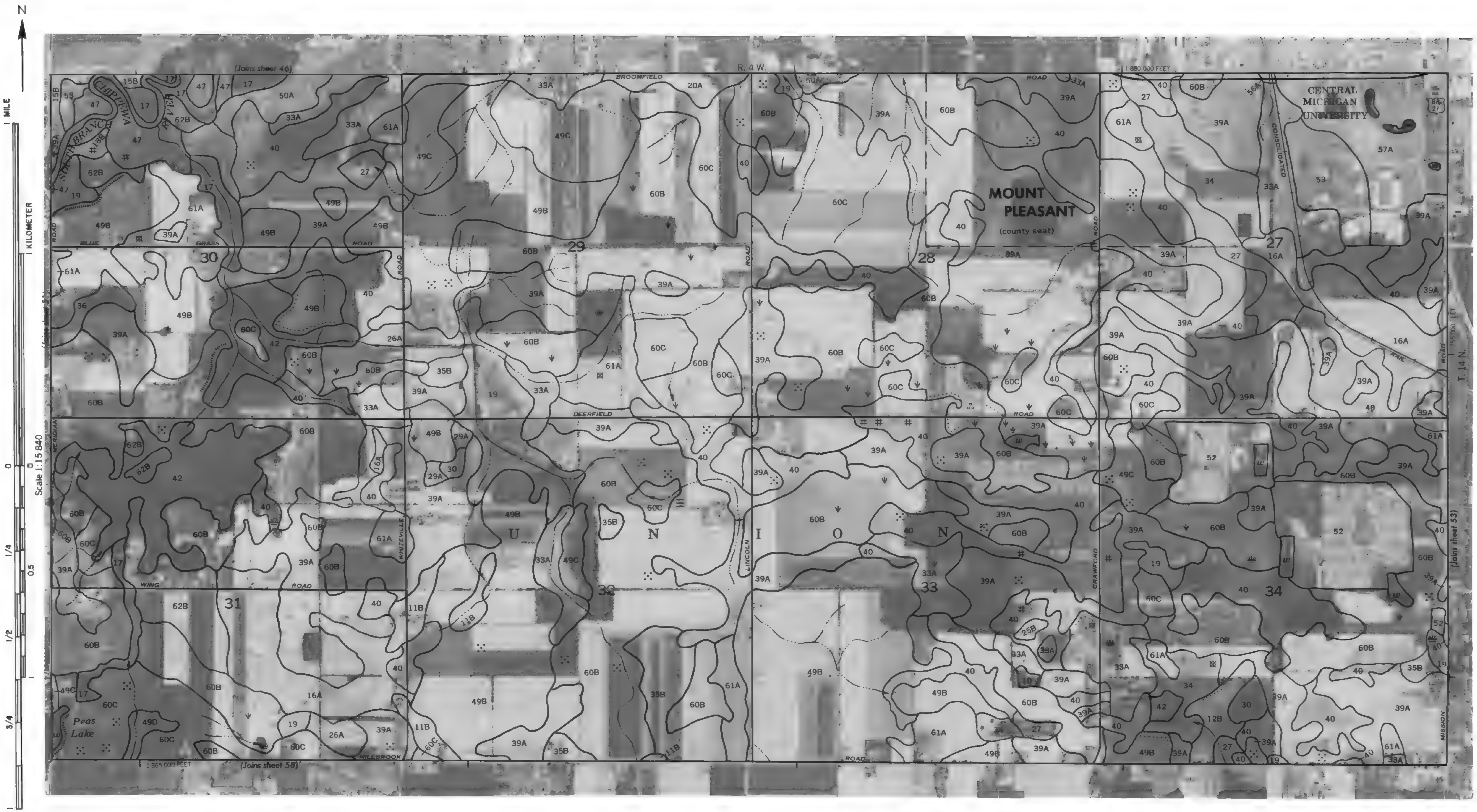


This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

51

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 52



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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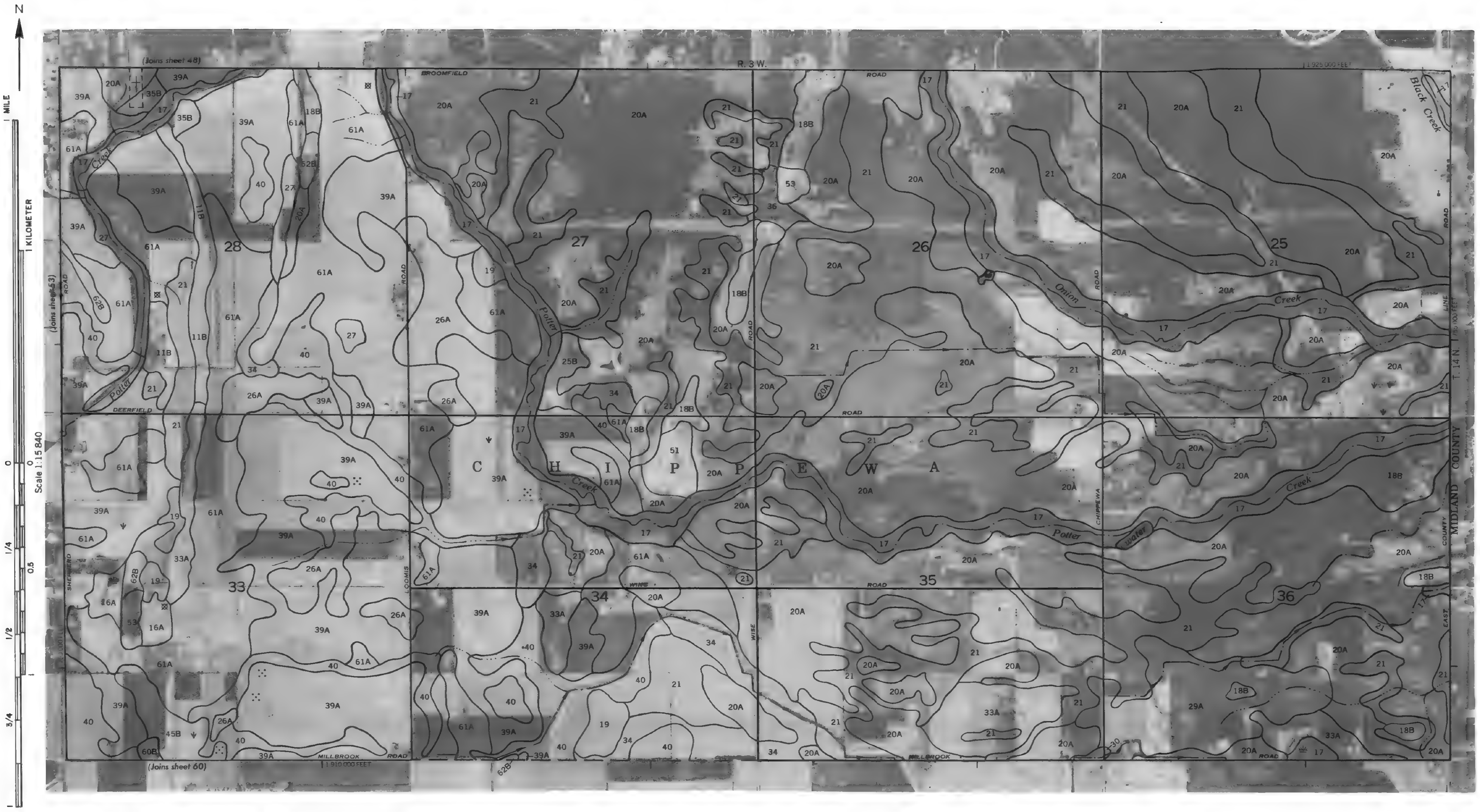
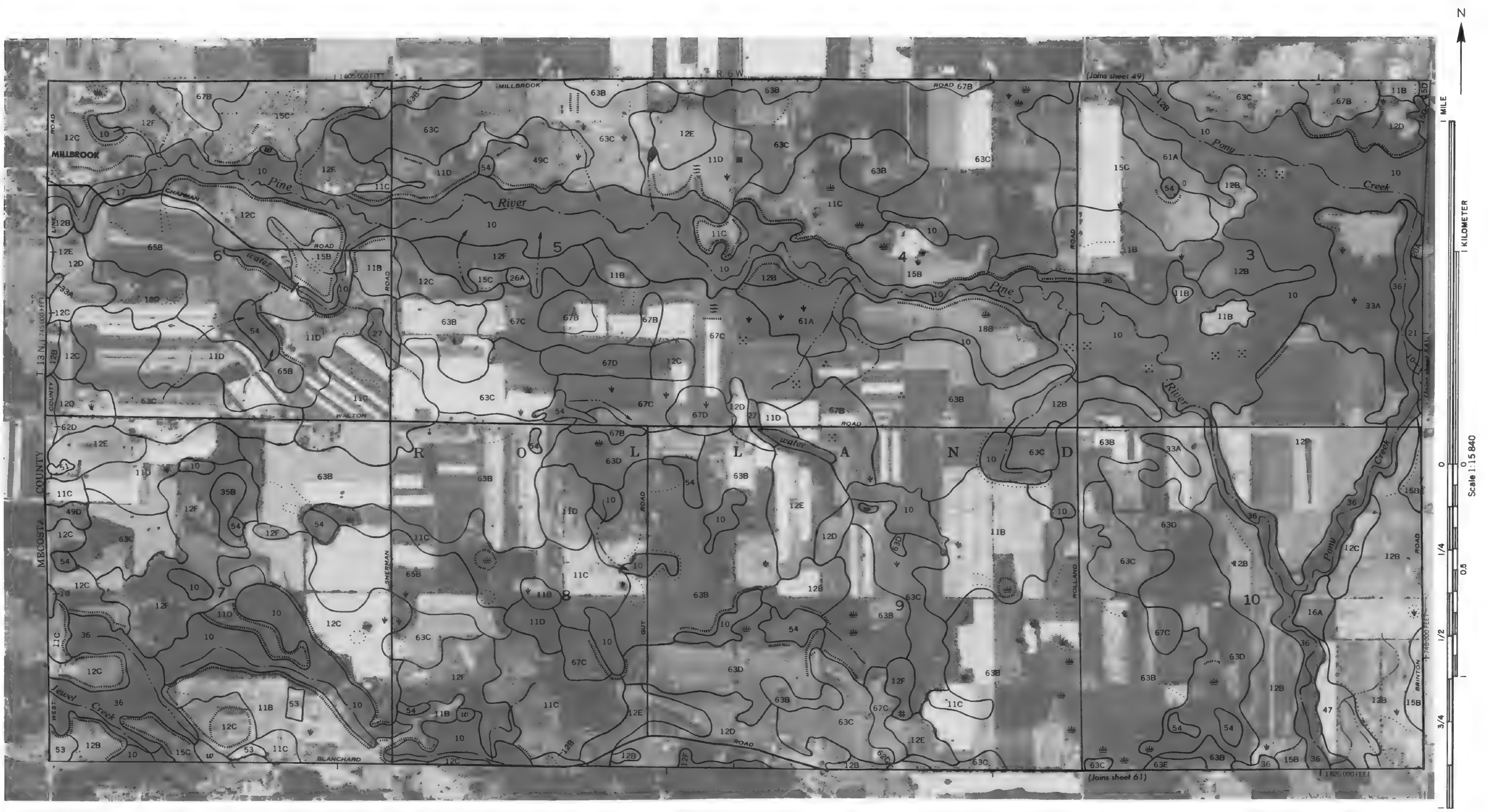
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 54

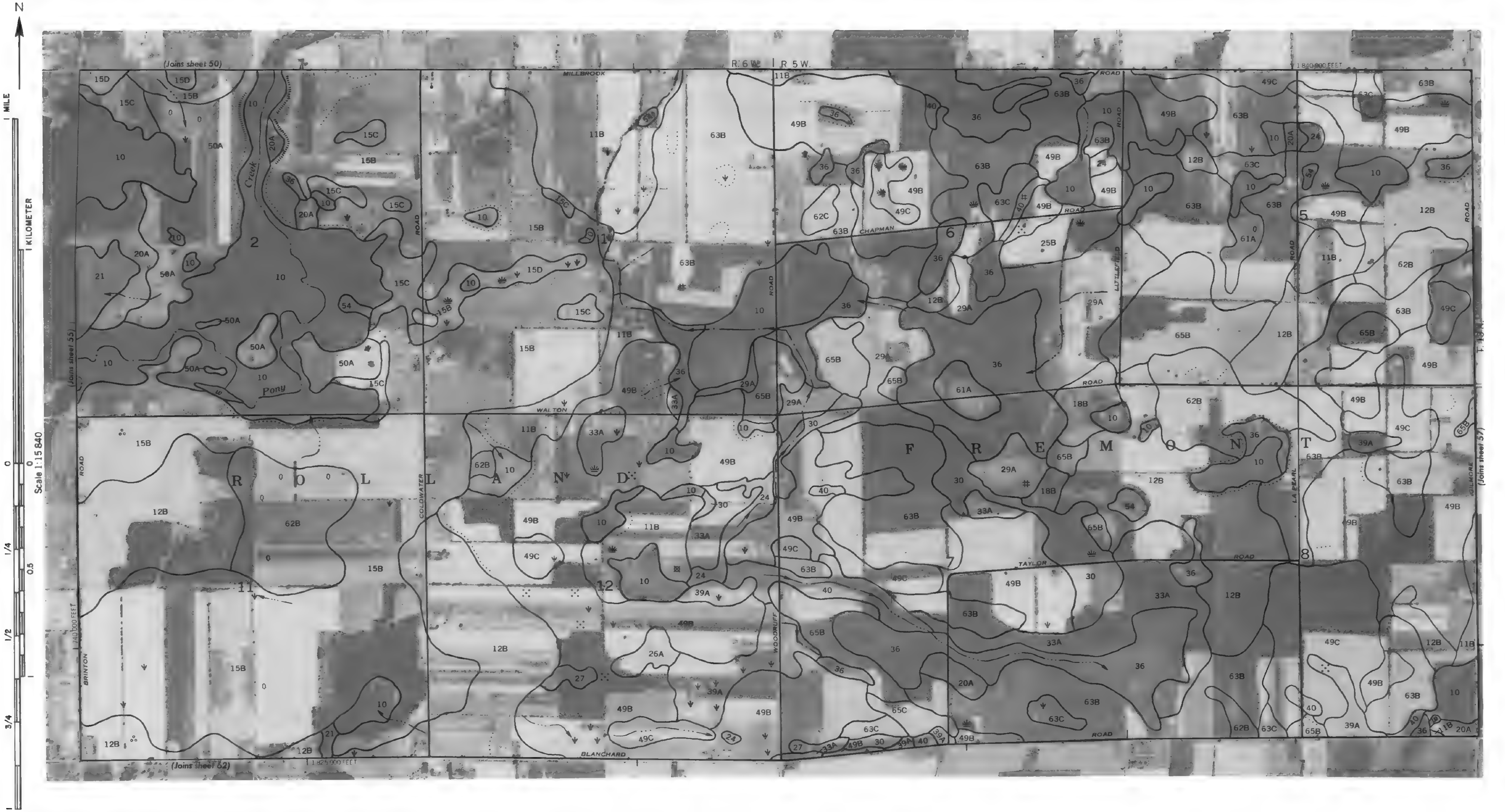


This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

56



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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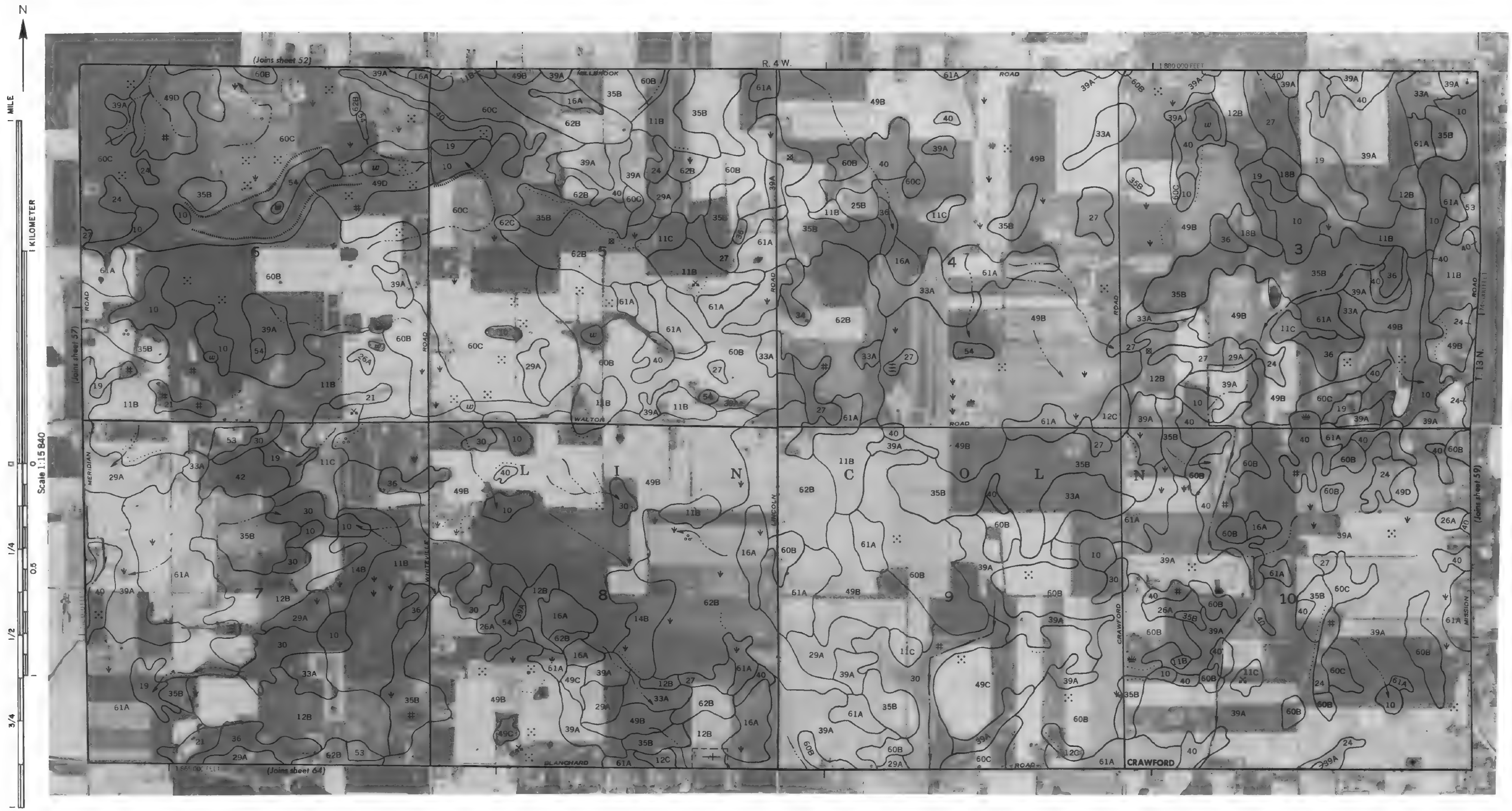
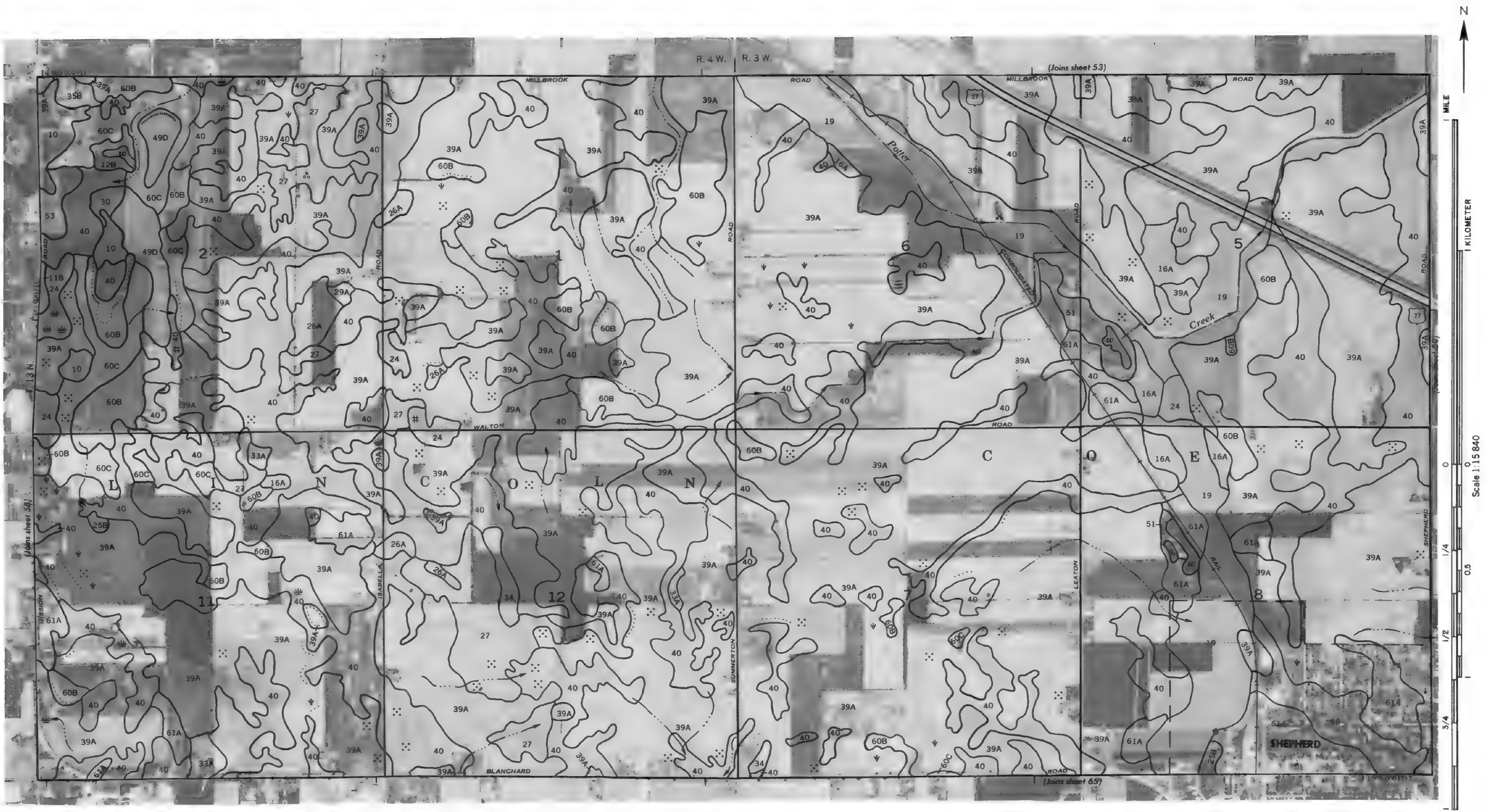
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 58



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 60

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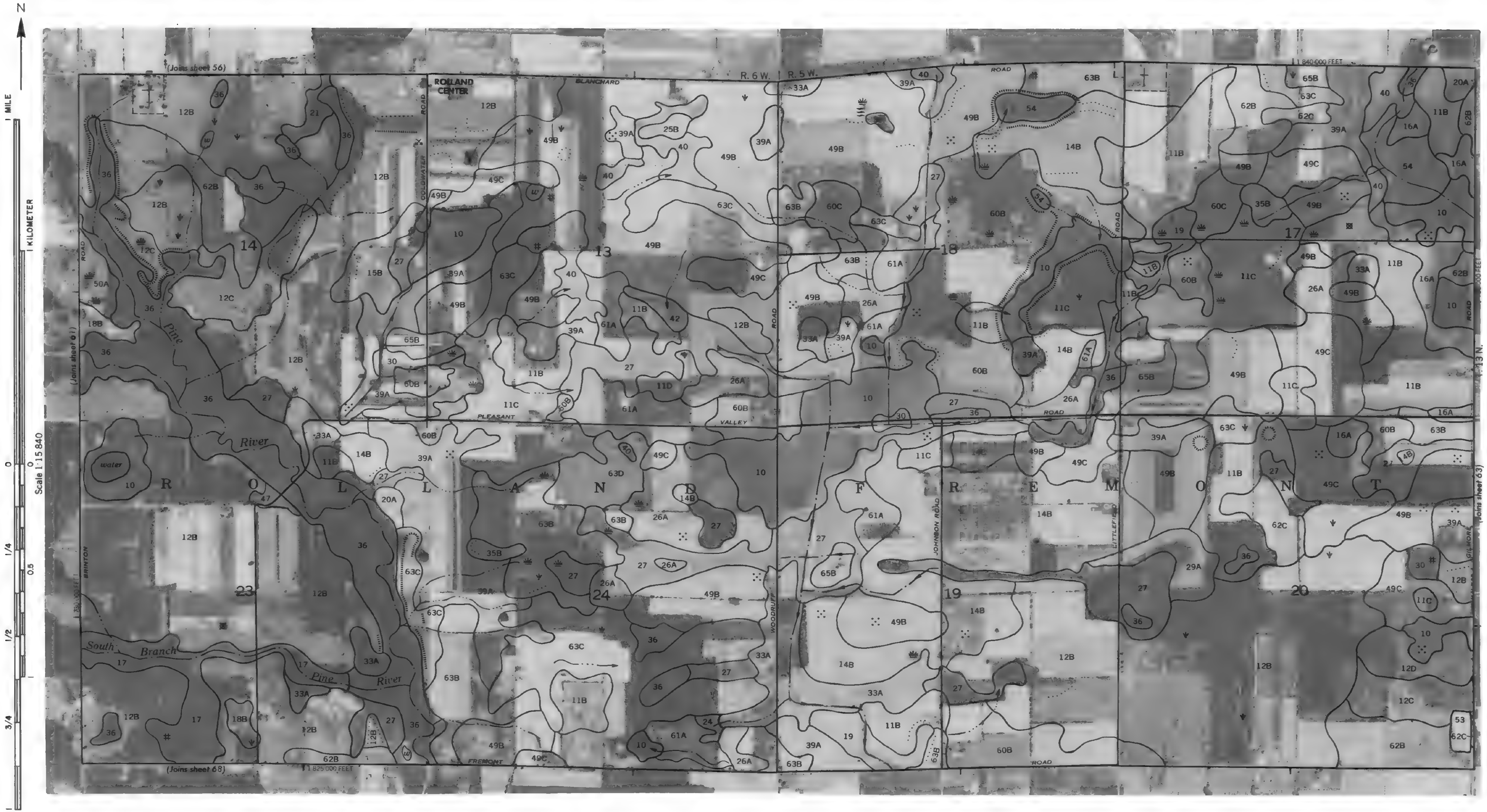
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 62



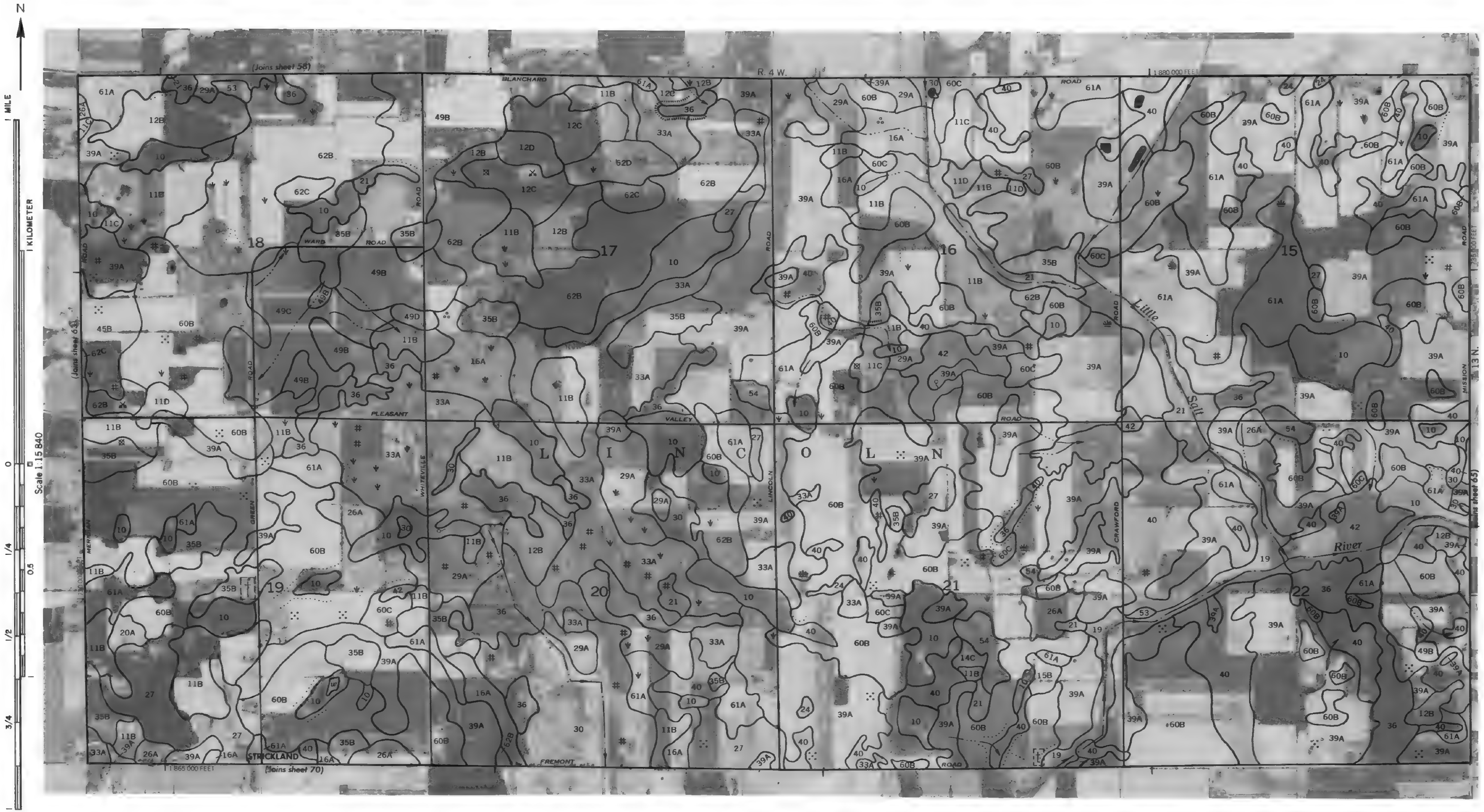
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 63

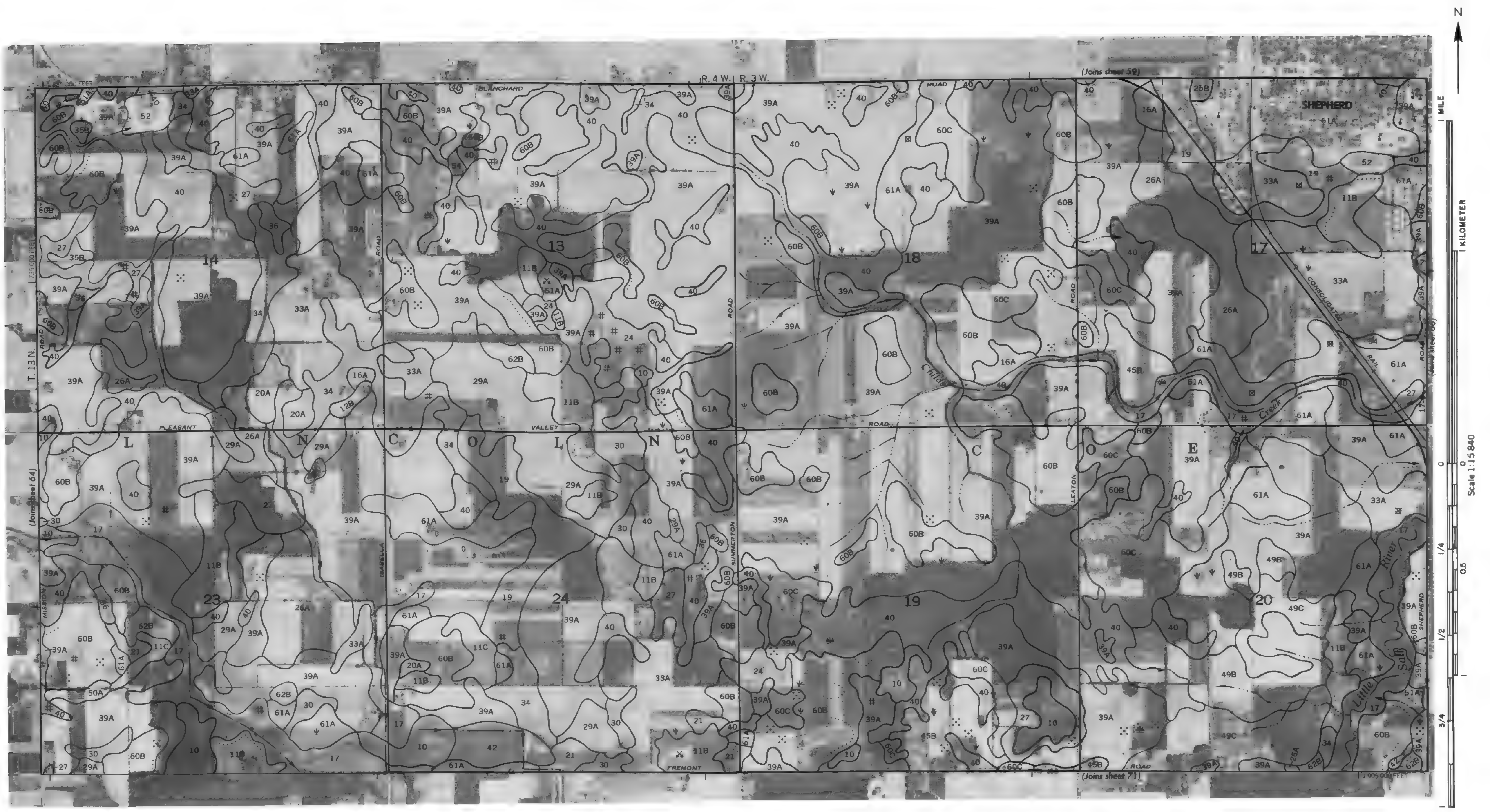
63

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 64



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 66

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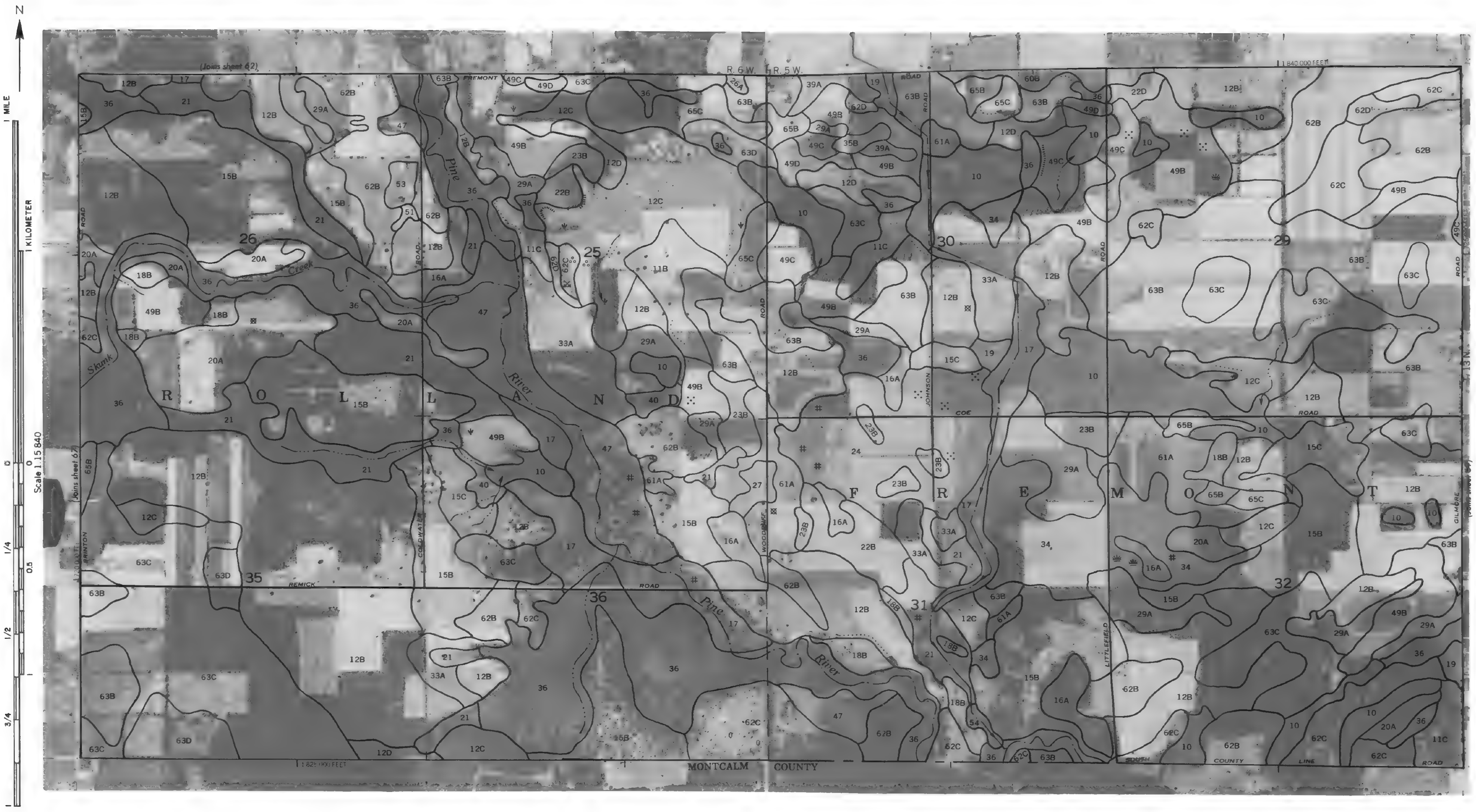
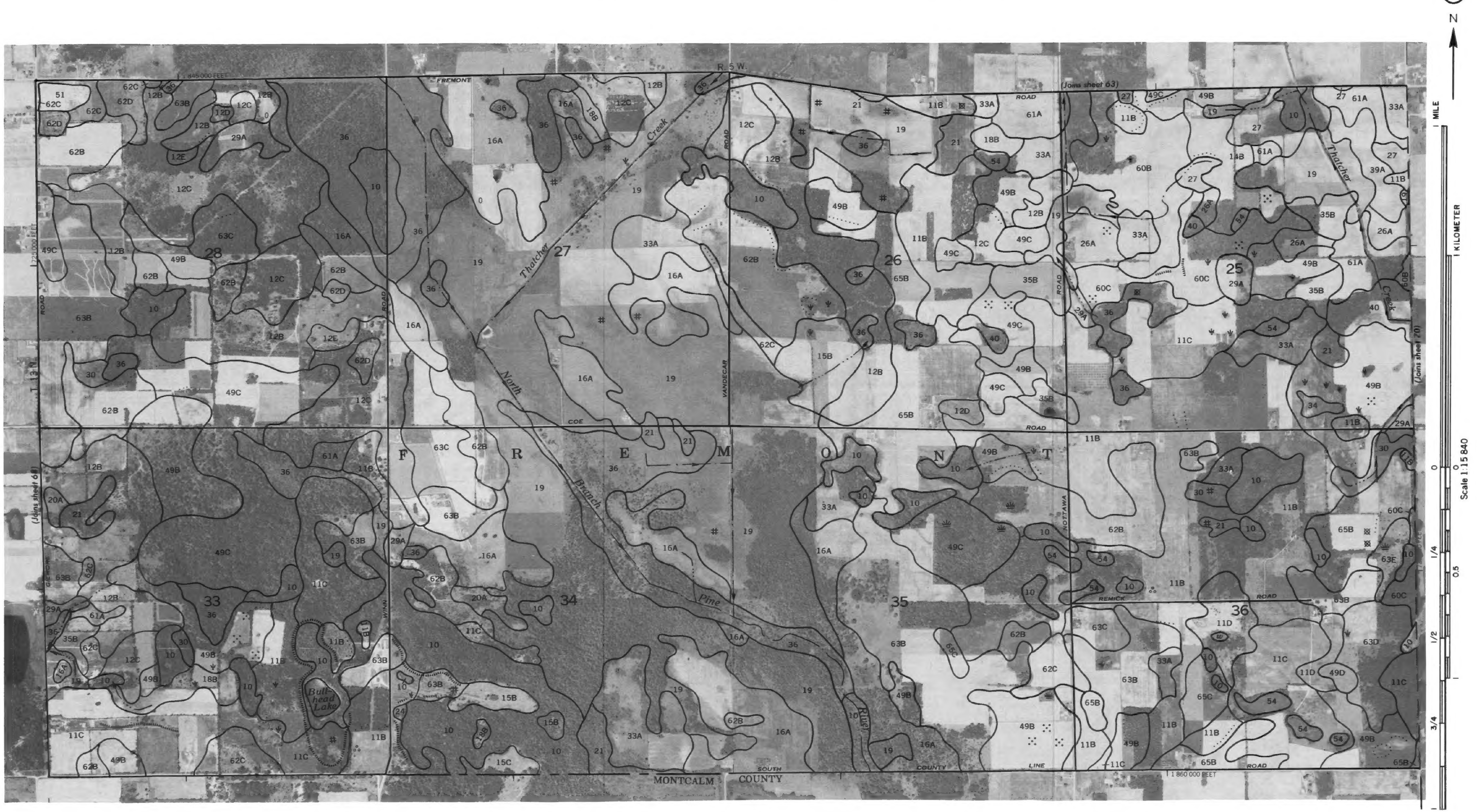
SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 68



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

1 MILE

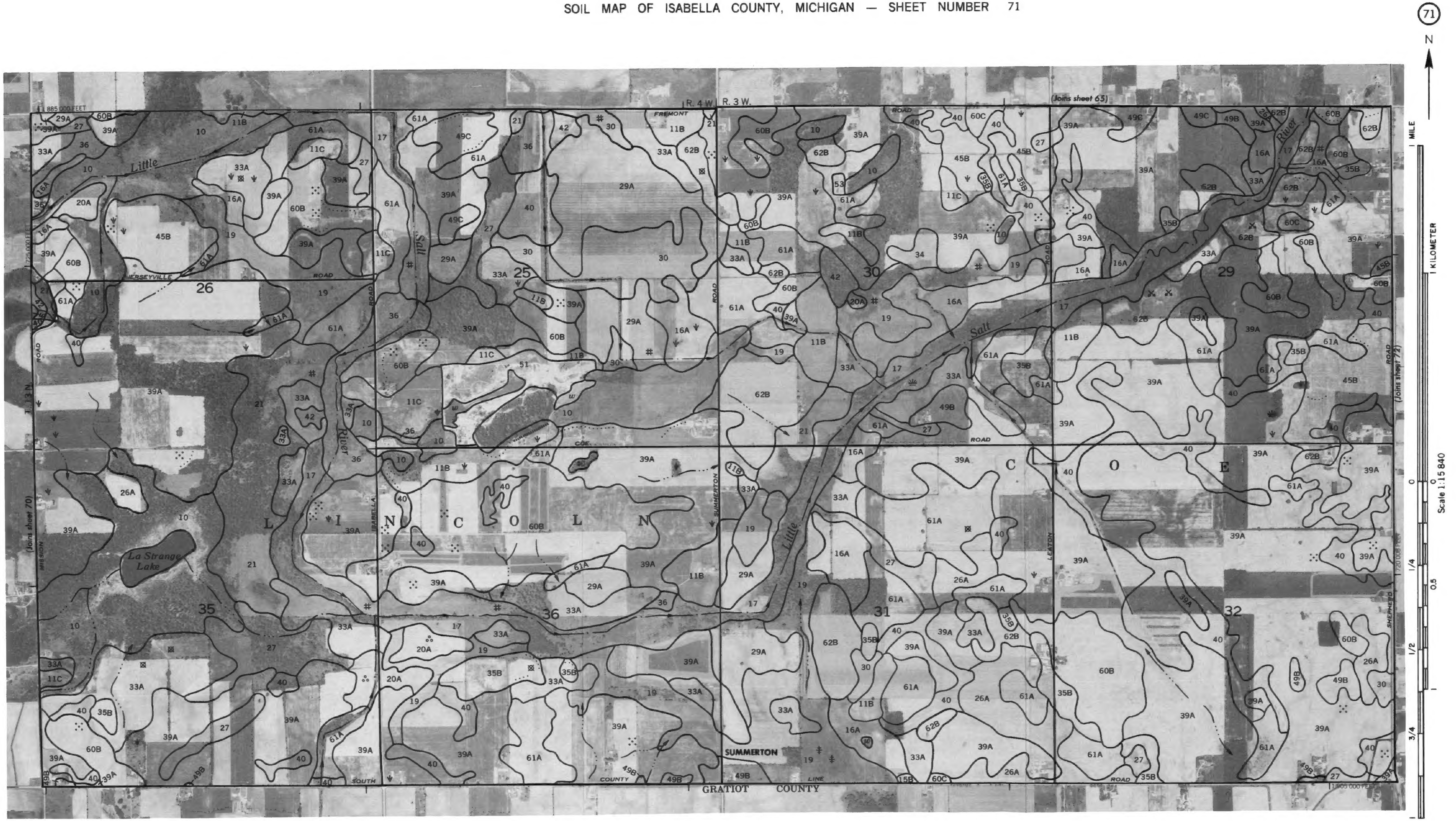
1 KILOMETER

Scale 1:15 840

0 1/4 1/2 3/4 1

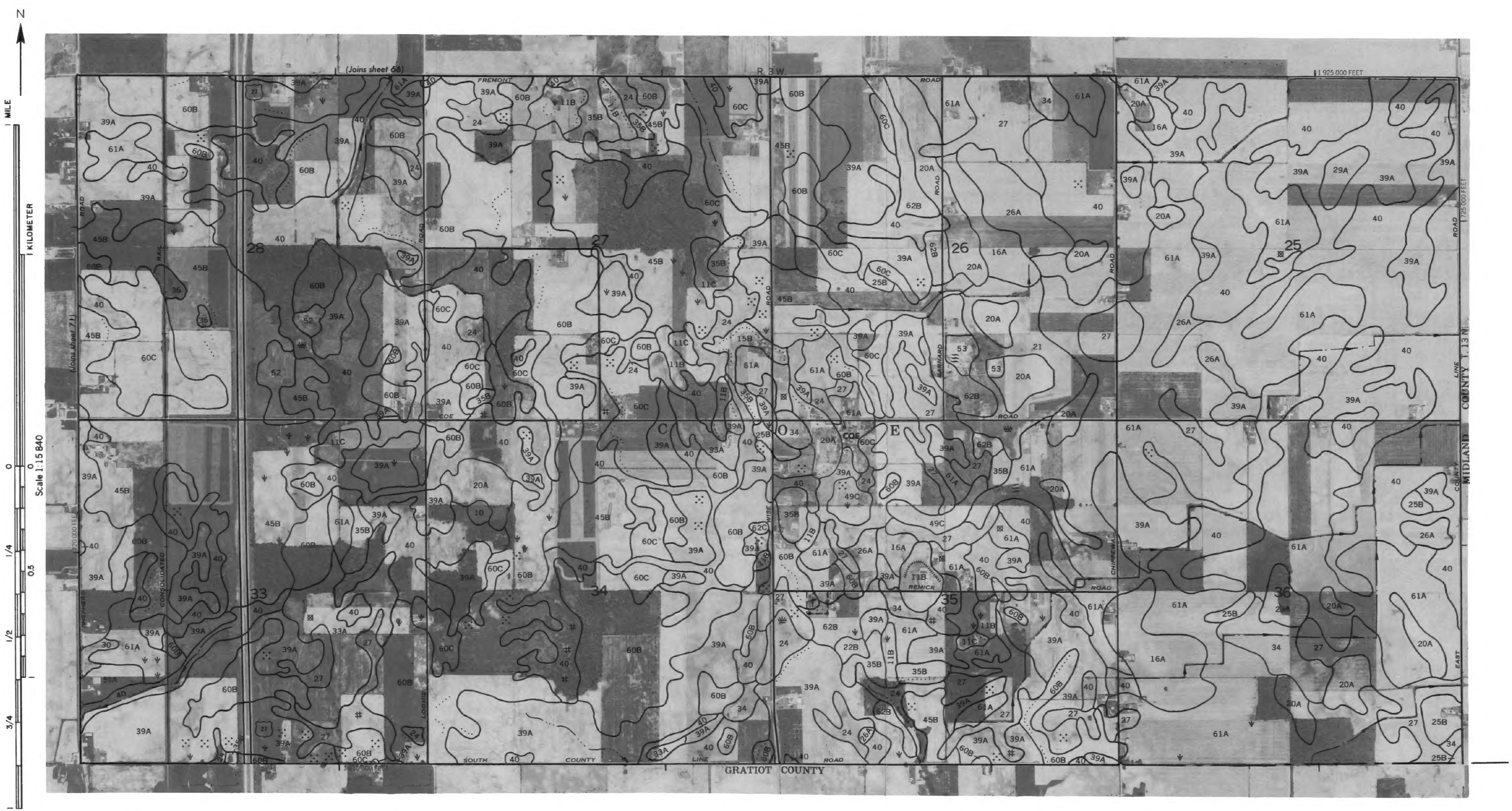
0 0.5 1

This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL MAP OF ISABELLA COUNTY, MICHIGAN — SHEET NUMBER 72



This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.